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ISSA INTERNATIONAL SPORTS SCIENCES ASSOCIATION

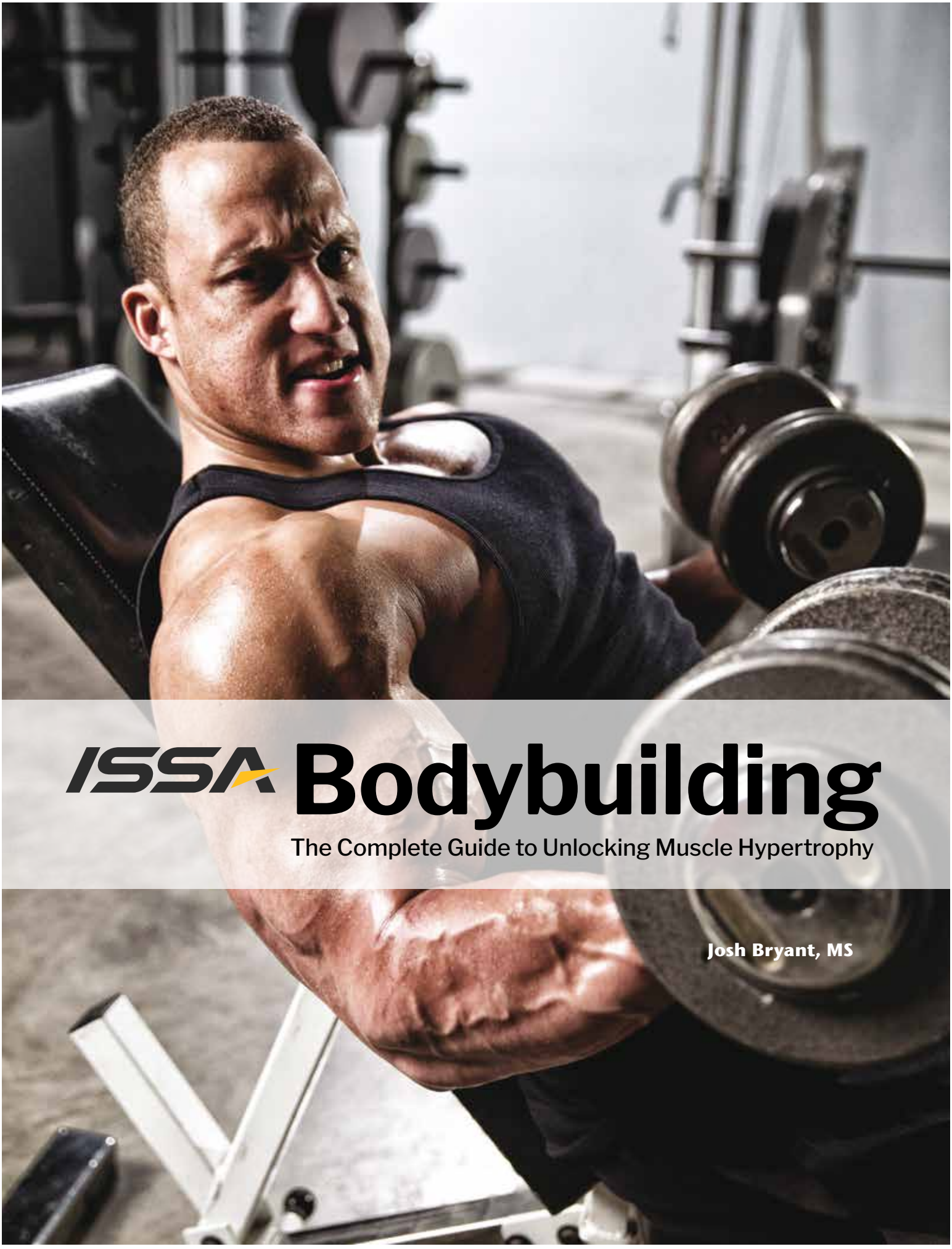
Bodybuilding

First Edition

The Complete Guide to Unlocking Muscle Hypertrophy

Josh Bryant, MS

Course Textbook for **BODYBUILDING SPECIALIST**



ISSA

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The Complete Guide to Unlocking Muscle Hypertrophy

Josh Bryant, MS

Bodybuilding: The Complete Guide to Unlocking Muscle Hypertrophy (Edition 1)

Official course text for: International Sports Sciences Association's Bodybuilding Specialist Program

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Josh Bryant is a speed, strength, and conditioning coach. Josh trains some of the strongest and most muscular athletes in the world in person at Metroflex Gym in Arlington, Texas, and via the Internet. Along with his receiving certifications from the International Sports Sciences Association in fitness training, nutrition, and conditioning, Josh was recently awarded the prestigious title of Master of Fitness Science (MFS) by the ISSA. He also has a Master's degree in Exercise Science. Josh has won many national and world titles in powerlifting and strongman and was the youngest person in powerlifting history, at 22, to bench press 600 pounds raw. Josh has squatted 909 pounds in the USPF, officially bench pressed 620 pounds raw, and officially deadlifted 800 pounds raw.

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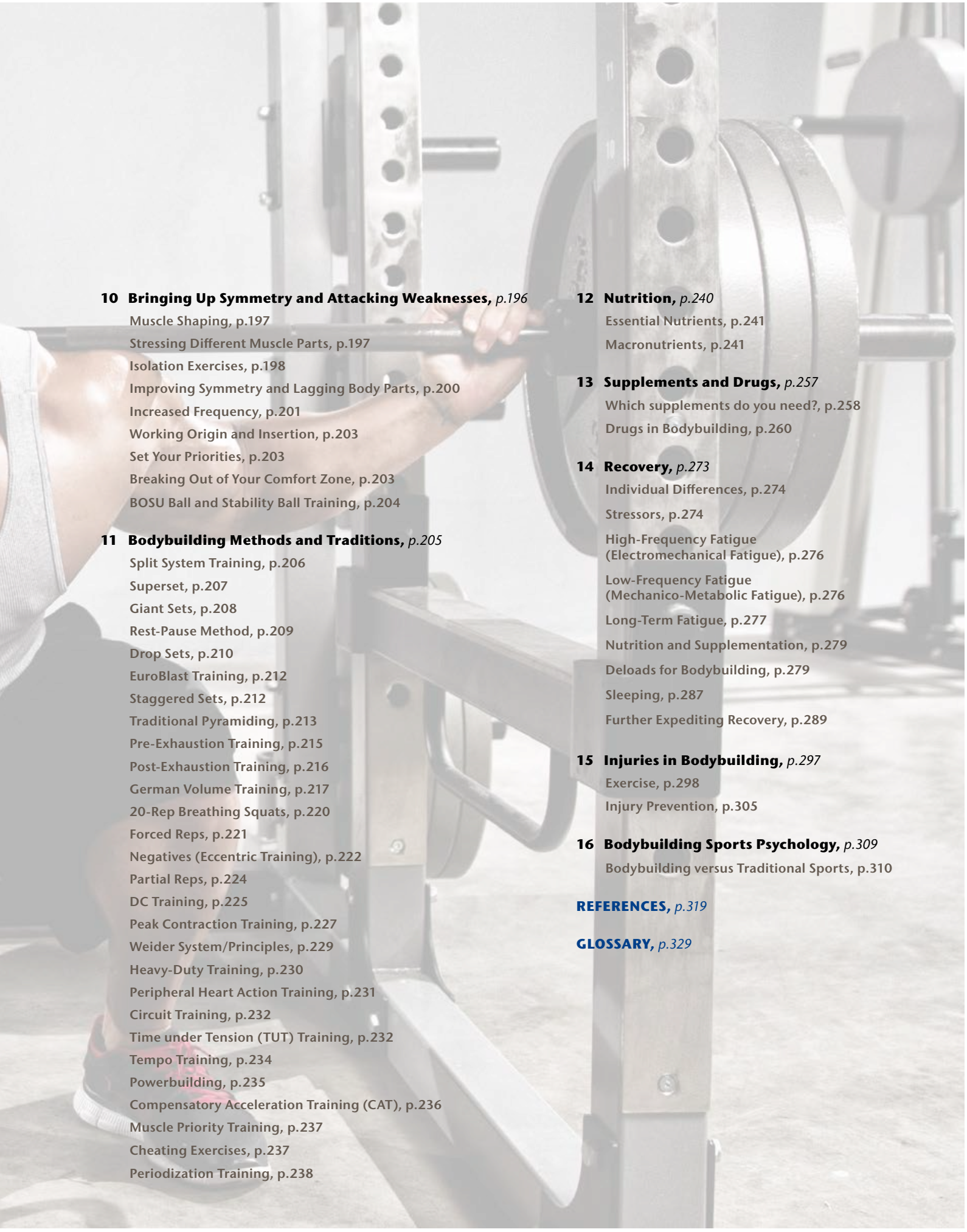

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TOPICS COVERED IN THIS UNIT

What Can You Expect to Learn

History of Bodybuilding

INTRODUCTION

Welcome to the ISSA's course on the exciting, and often misunderstood, world of bodybuilding. When the layperson thinks about the sport of bodybuilding, images of big, dumb guys grunting and throwing weight around are often conjured up. This could not be further from the truth! As you read and work your way through this course, you will see that the serious bodybuilder (or his or her coach) is part athlete, part scientist, and part artist. If you are new to bodybuilding, this may sound crazy to you, but I am confident that upon completing this course, you will understand and agree with my sentiments on the sport of bodybuilding.

Modern bodybuilding is unlike other sports. Nearly every sport requires the athlete to perform some sort of skilled movement or display great speed, strength, or stamina. However, bodybuilding is unique because developing an aesthetically pleasing appearance by selectively maximizing your muscles' mass is the sport's ultimate objective.

This course is designed to help you understand everything that building a champion physique entails. Not only will this help you become more proficient in the art and science of bodybuilding, but also the information contained in these pages will help you become a better trainer for all types of people with varying goals.

To ensure your complete understanding of the material contained in this course, please read through slowly and move to the next unit only after you feel you have mastered the information. To some extent, each unit builds off the previous unit, so read and study them in sequence.

WHAT CAN YOU EXPECT TO LEARN

Upon completion of the ISSA's bodybuilding course, you will have all the knowledge necessary to prepare an athlete for a high-level bodybuilding or physique competition. But many who take this course will never go down that path; for these trainers, the course will provide essential information that can help them train the "everyday" clients who want to look and feel their best. All trainers can benefit from the information in this bodybuilding course, not only individuals looking to enter the sport of bodybuilding!

In the ensuing pages, we will cover everything from which exercises to do, the science behind what makes these so effective, and when to do them to the different types of periodization and how to decide which is right for your client.

We will also review one of the most important aspects of bodybuilding: nutrition. As the old adage goes, "You can't outwork a bad diet!" Along with nutrition, we will discuss supplementation strategies and even talk a bit about the unfortunate reality of anabolic steroid use in bodybuilding (which the ISSA and I highly discourage).

HISTORY OF BODYBUILDING

Although the first major bodybuilding show did not occur until 1901, it would be untrue to say that bodybuilding began then. Throughout history, men of strength have been the principal actors in fables, songs, poems, and art. The ancient Greeks commemorated Hercules by casting him in stone. His statue remained the ideal by which those who followed him in time were judged—both from the standpoint of strength as well as physique.

The beginning of what we today call bodybuilding can be traced back to Eugene Sandow in the late 19th century. Eugene Sandow, "the father of modern bodybuilding," was a Prussian-born strongman/strength athlete who used classic Greek statues to develop what he called a perfect physique. Sandow organized the first major bodybuilding competition in London in 1901. The bodybuilding show was so successful that hordes of people were turned away at the door.

During the early 1900s, physique exhibitions were popular additions to Olympic weightlifting contests. In fact, at least two or three physical culture magazines sponsored photo contests, the most memorable one being that in which the legendary Charles Atlas claimed the title of the world's most perfectly developed male.

It is hard to pinpoint the precise time that bodybuilding began to be regarded as a sport, but it certainly appears to relate to the fact that the early bodybuilders needed to be not only successful athletes but also well-built. All types of arguments, pro and con, have been advanced regarding the place of bodybuilding in the world of sport.

The year 1939 heralded the first Mr. America contest, held by the Amateur Athletic Union (AAU). But this competition did not strictly focus on how the athlete looked. In the early Mr. America contest, the competitors were judged not only by their appearance but also on their performance of feats of strength and athletic ability. This athletic ability portion of a bodybuilding competition continued into the 1960s before being dropped.

Bodybuilding continued to grow throughout the 1950s and 1960s. Great champions emerged from this era, including Steve Reeves, Reg Park, and Bill Pearl. During this period, bodybuilding gyms became much more common throughout the country. More and more people began to participate in weightlifting for both health purposes and aesthetics.

In the 1960s, bodybuilders began appearing regularly on television and in movies. This only helped solidify bodybuilding as a sport here for the long haul. What started as a small number of people competing against each other had grown into a sport garnering worldwide interest.

The late 1960s through the 1970s produced the most famous bodybuilder of all time, Arnold Schwarzenegger. Arnold won his first Mr. Olympia contest in 1970 at 23 years of age; this still stands as a record for the youngest Mr. Olympia. He went on to win the title of Mr. Olympia seven times (1970–1975 and again in 1980).

A catalyst for bodybuilding's explosion during this time was a documentary titled *Pumping Iron*, which followed Arnold Schwarzenegger in his run up to his 1975 Mr. Olympia title. The film followed Schwarzenegger, Franco Colombo, and Lou Ferrigno, among others, in the months leading up to the Mr. Olympia contest. It was a commercial success and led to Arnold Schwarzenegger and bodybuilding becoming part of mainstream America.

The 1980s, 1990s, and 2000s saw the rise of the "mass monsters." The bodybuilders of this time grew bigger and bigger. Competitors such as Lee Haney, Dorian Yates, Markus Ruhl, and Ronnie Coleman brought a size to the bodybuilding stage that had never been seen. Ronnie Coleman reigned supreme during this era, winning Mr. Olympia eight times (1998–2005), a number that ties him with Lee Haney for most Olympia wins in a career.

Although there have been some outstanding bodybuilders recently, the man currently to beat is Phil Heath. Heath has won the Mr. Olympia title

the last six years running (2011–2016) and shows no signs of being beat anytime soon. It is truly an exciting time to be involved in this sport!

Whether you are planning to coach bodybuilders, are competing yourself, or just want to expand your knowledge to better service your clients, this course will help you. Upon completion of this course, you will be able to prescribe exercises (and give scientific evidence of their validity), successfully periodize a training cycle, offer sound nutritional guidance, and understand (and implement) an array of both common and uncommon modalities. Once you have completed this course, you will have the requisite knowledge to take somebody from beginner to stage ready!

Make sure to read each unit thoroughly and to complete them in order. Give yourself time to let the ideas sink in before you move on.

Now get ready to enter the wonderful and exciting world of bodybuilding!

TOPICS COVERED IN THIS UNIT

It's All about the Muscle

Muscle Structure and Function

- Microstructure
- Reciprocal Innervation
- Sliding Filament Theory
- Muscle Fiber Pennation Arrangement
- Muscle Fiber Types

Connective Tissue

- Tendons
- Ligaments
- Cartilage

Nervous System: The Mind and Body Link

- Theory of Neuromuscular Activity
- Neural Adaptations
- Hypertrophy
- Hyperplasia
- Satellite Cells

A Few Last Words

UNIT 1

HYPERTROPHY AND ADAPTATIONS TO STRENGTH TRAINING

Bodybuilders are known for having one thing in mind: How do I get big?

As you will discover in the pages of this book and course, you've got to eat well and train hard and smart. But there's more—much more than what you can see in the mirror.

Let's take a look at what happens to your body behind the scenes. By taking time to understand the structure of **muscle** and how it responds to training, you will be better able to develop scientifically driven programs, thus putting you and your client in the best position to succeed.

Muscle: A group of motor units physically separated by a membrane from other groups of motor units.

Smooth Muscle: Governed by the autonomic nervous system and includes the muscles that line the digestive tract and protect the blood vessels.

Cardiac Muscle: Which includes the heart, as smooth muscle is modulated by the autonomic nervous system.

Skeletal Muscle: Blends into tendinous insertions that attach to bones, pulling on them, which generates desired movement.

Motor Unit: Consists of a single neuron and all the muscle fibers innervated by it.

Myofibrils: Small bundles of myofilaments.

IT'S ALL ABOUT THE MUSCLE

The human body has three types of muscle: **Smooth muscle**, which is governed by the autonomic nervous system, includes the muscles that line the digestive tract and protect the blood vessels. **Cardiac muscle**, which includes the heart, like smooth muscle, is modulated by the autonomic nervous system. The functioning of smooth and cardiac muscle is largely involuntary. **Skeletal muscle**, the type bodybuilders are most concerned with building, blends into tendinous insertions that attach to bones, pulling on them, thereby generating desired movement.

When the body has to move, it responds by activating a slew of muscles. The forces generated by the body internally must overcome the forces imposed on the body externally.

During strength training, the body must overcome gravitational and inertial forces, which are magnified when a barbell is in people's hands, on their backs, or overhead. Cumulatively, strength training will make skeletal muscles stronger, make cardiac muscle more efficient, and enhance the functioning of smooth muscle.

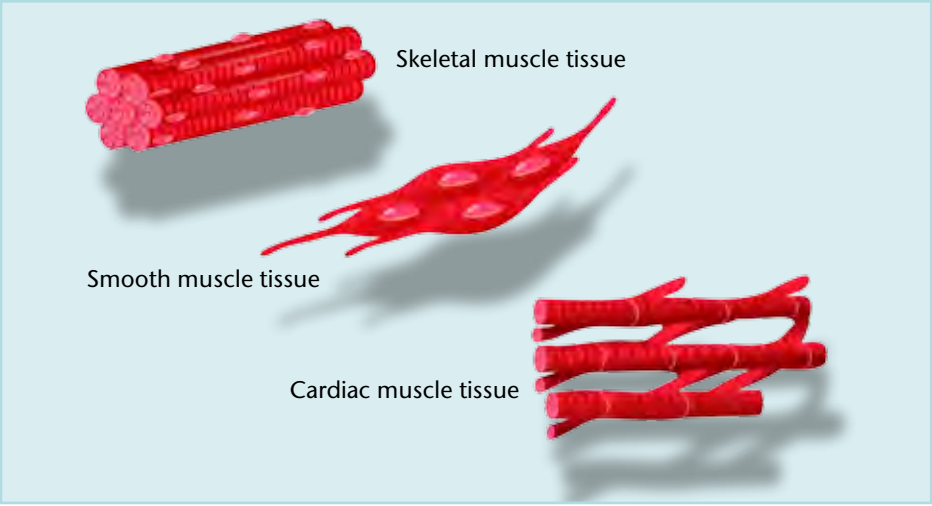

Figure 1.1 Muscle types

Adapted from Fitness: The Complete Guide, *International Sports Sciences Association. 2017.*

MUSCLE STRUCTURE AND FUNCTION

MICROSTRUCTURE

Muscles are composed largely of proteins, which are hierarchically organized from large groups to small fibers. A muscle is a group of **motor unit**s physically separated by a membrane from other groups of motor units. A muscle is connected to bones through tendons. (Refer to Figure 1.3 for a diagram of muscle composition.)

A motor unit consists of a single neuron and all the muscle fibers innervated by it. The ratio of nerves to fibers determines the fine motor control available to that muscle. For example, the hand has fewer fibers per motor unit than do the muscles of the calf.

The muscle fiber is composed of **myofibrils**, which are

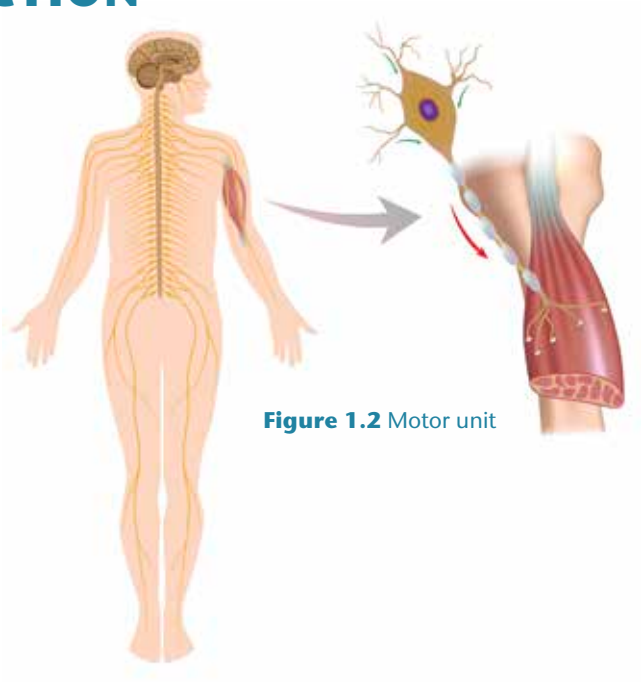

Figure 1.2 Motor unit

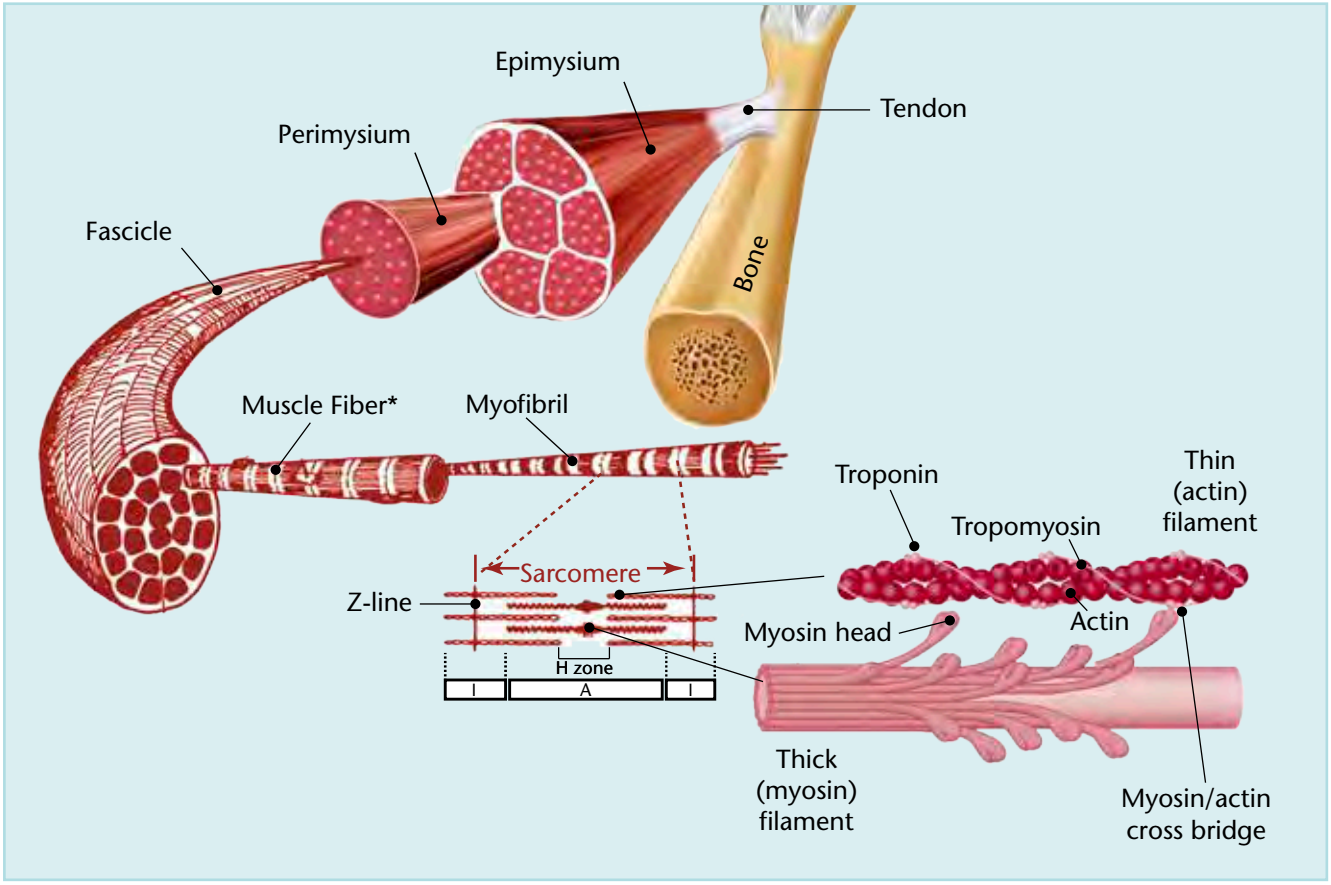

Figure 1.3 Organization of human skeletal muscle

Myofilaments: The elements of the muscle that shorten upon contraction.

Myosin: Short, thick filaments that make up part of myofilaments.

Actin: Long, thin filaments that make up part of myofilaments.

small bundles of **myofilaments**. Myofilaments are the elements of the muscle that actually shorten upon contraction. Myofilaments are mainly composed of two types of protein: **myosin** (short, thick filaments) and **actin** (long, thin filaments). Two other important proteins composing myofibrils are troponin and tropomyosin.

RECIPROCAL INNERVATION

Reciprocal Innervation: When a prime mover muscle (or group of muscles) contracts, the opposing muscle (or group) relaxes.

When a prime mover muscle (or group of muscles) contracts, the opposing muscle (or group) relaxes. When locking out a bench press, the triceps are the prime mover; the biceps relax as you push the weight to completion. This phenomenon is called **reciprocal innervation**. Without this reciprocity, muscle actions would be very jerky and weak at best or, at worst, result in no movement at all. The contracting muscle is referred to as the agonist, whereas the relaxed is the antagonist.

SLIDING FILAMENT THEORY

The strength of contraction in a muscle depends, in large part, upon the number of muscle fibers involved: the more muscle fibers, the stronger the contraction.

Sliding Filament Theory: This theory states that a myofibril contracts by the actin and myosin filaments sliding over each other. Chemical bonds and receptor sites on the myofilaments attract each other, allowing the contraction to be held until fatigue interferes.

The **sliding filament theory** states that a myofibril contracts by the actin and myosin filaments sliding over each other. Chemical bonds and receptor sites on the myofilaments attract each other, allowing the contraction to be held until fatigue interferes.

MUSCLE FIBER PENNATION ARRANGEMENT

The alignment of the muscle fibers has a distinct effect on the ability to generate force. Fusiform arrangement occurs when the fibers are parallel to the tendons and therefore can contract at great speeds without a loss in total force output.

A unipennate muscle will have fiber alignment going from one side to the other in regard to the tendon, whereas a bipennate muscle will have alignment of fibers on both sides of the muscle.

Muscles with a unipennate, bipennate, or multipennate arrangement are capable of producing higher amounts of force than a fusiform arrangement can but at the expense of contractile velocity. It is believed that fiber arrangement is determined by genetics, but it may be altered somewhat with training.

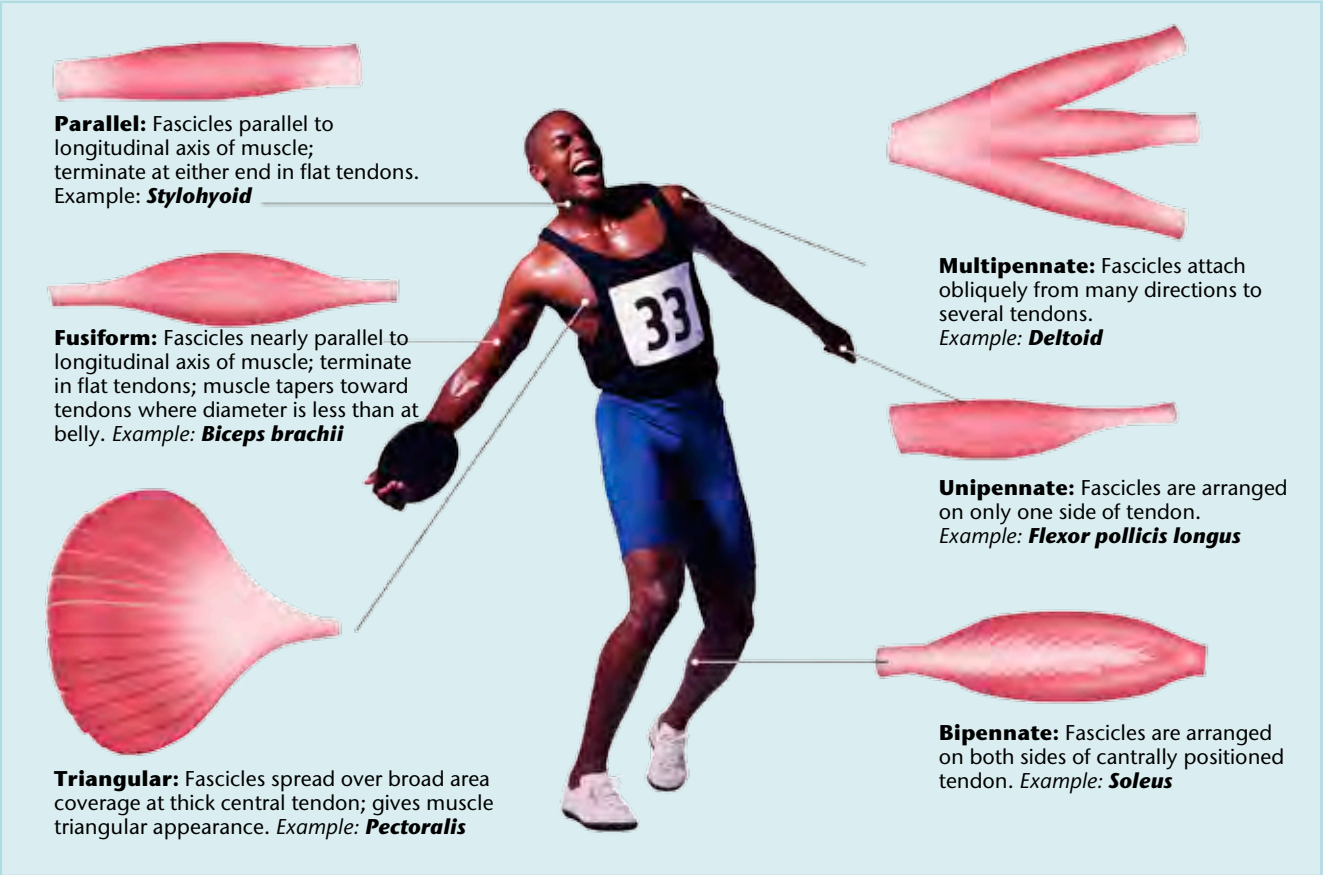
Parallel: Fascicles parallel to longitudinal axis of muscle; terminate at either end in flat tendons. Example: ***Stylohyoid***
Fusiform: Fascicles nearly parallel to longitudinal axis of muscle; terminate in flat tendons; muscle tapers toward tendons where diameter is less than at belly. *Example:* ***Biceps brachii***
Triangular: Fascicles spread over broad area coverage at thick central tendon; gives muscle triangular appearance. *Example:* ***Pectoralis***
Multipennate: Fascicles attach obliquely from many directions to several tendons. *Example:* ***Deltoid***
Unipennate: Fascicles are arranged on only one side of tendon. *Example:* ***Flexor pollicis longus***
Bipennate: Fascicles are arranged on both sides of cantrally positioned tendon. *Example:* ***Soleus***

Figure 1.4 Muscle fiber arrangements

MUSCLE FIBER TYPES

Three distinct types of muscle fiber are found in skeletal muscle: Type I, Type IIa, and Type IIx. The percentage of each varies from person to person and from one muscle to another in the same person.

Type I muscle fibers (slow-twitch or red fiber) are highly resistant to fatigue and injury, but their force output is extremely low. Activities performed in the aerobic pathway call upon these muscle fibers.

Type IIa muscle fibers (fast-twitch or intermediate fibers) are larger in size and much stronger than Type I fibers are. They have a high capacity for glycolytic activity—they can produce high-force output for long periods.

Type IIx muscle fibers (fast-twitch muscle fibers) are often referred to as "couch potato fibers" because of their prevalence in sedentary individuals. Research has shown that 16% of a sedentary person's total muscle mass is of this fiber type.

Type I Muscle Fibers: (Slow-twitch or red fiber) are highly resistant to fatigue and injury, but their force output is very low. Activities performed in the aerobic pathway call upon these muscle fibers.

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Type IIx Muscle Fibers: (Fast-twitch muscle fibers) are often referred to as "couch potato fibers" because of their prevalence in sedentary individuals. Research has shown that 16% of a sedentary person's total muscle mass is of this fiber type.

Table 1.1: Characteristics of Fiber Types

Characteristic	Type I Slow Oxidative	Type IIA Fast Oxidative Glycolytic	Type IIx Fast Glycolytic	Type IIC** Fast Oxidative Glycolytic
Myoglobin Content	High	Intermediate	Low	Intermediate
Capillary Supply (Per Fiber)	4	4	3	4
Fiber Area	Small	Intermediate	Large	Large
Motor Neuron and Axon Size	Small	Intermediate	Large	Large
Typical Innervation	540/Units	440/Units	750/Units	----
Axon Conduction Velocity	85	100	100	100
Liability to Accommodation	Low	Medium	Medium	Medium
Mitochondrial Enzymes	Intermediate	High	Low	----
Glycolytic Enzymes	Low	Intermediate	High	----
Fat Content	High	Intermediate	Low	Intermediate
Myofibrillar ATPase	Low	High	High	High
Time To Peak Tension (msec)	80	40	30	----
Tension Developed	Low	Intermediate	High	High
Resistance To Fatigue	High	Intermediate	Low	Intermediate
Oxidative Capacity	High	High	Low	Intermediate
Liability To Recruitment	High	Intermediate	Low	Intermediate

** Type IIC (alternately referred to as intermediary fibers) possibly result from the fusion of Type IIX with satellite cells. Their properties are still under investigation.

ADAPTED FROM SHEPARD, R.J. 1982, PHYSIOLOGY AND BIOCHEMISTRY OF EXERCISE. PRAEGER PUBLISHERS, NEW YORK.

Type IIx fibers are extremely strong, but they have nearly no resistance to fatigue or injury. In fact, they are so strong and susceptible to injury, that when they are used, they often are damaged beyond repair. Unless the body can repair the muscle cell, it is broken down and sloughed off into the amino acid pool. In most cases, sedentary people immediately lose their Type IIx fibers when beginning a training program. However, neural efficiency is increased via strength training, resulting in the production of higher forces for longer periods.

A fourth type of fiber, Type IIc, is the result of Type IIx fibers' "fusing" with surrounding satellite cells.

As noted earlier, Type IIx fibers are destroyed when they are used because of their fast-twitch capacity and poor recovery ability. When muscle fibers are damaged from training stress, a highly catabolic hormone called cortisol is released to facilitate the cleanup operation.

However, if cortisol is blocked, the Type IIx fibers will fuse with surrounding satellite cells (non-contractile muscle cells that help support or bulwark the tenuous IIx fibers). The result of fusion is a Type IIc fiber. Insulin-like growth factor-1 (IGF-1) stimulates the fusion process, which has huge implications for bodybuilders.

Fast-twitch fibers are serviced with thicker nerves, giving them a greater contractile impulse

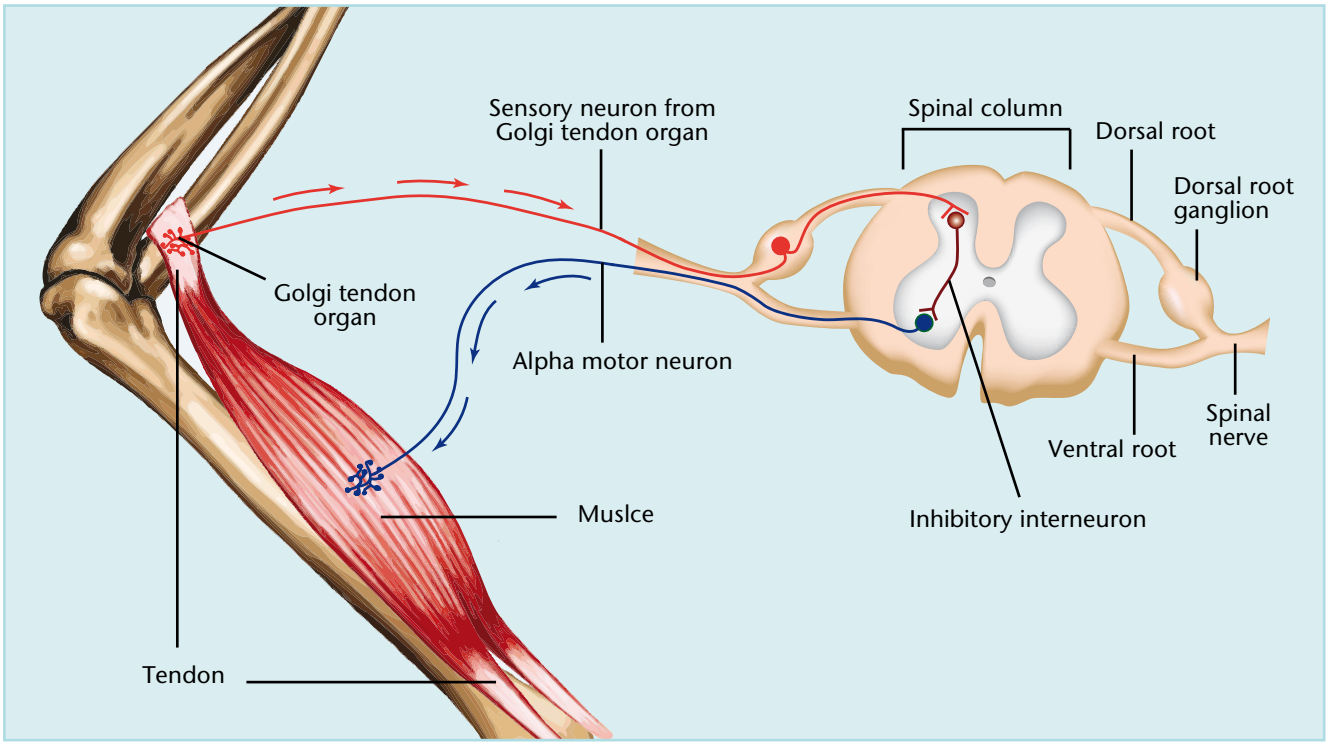


Figure 1.5 Feedback loop

(measured in number of twitches per second). Slow-twitch fibers have smaller nerves (thus twitch fewer times per second) but have a high degree of oxygen-using capacity stemming from the greater number of mitochondria (the cells' "powerhouses" where adenosine-5'-triphosphate, or ATP, is synthesized) and a higher concentration of myoglobin and other oxygen-metabolizing enzymes.

CONNECTIVE TISSUE

The primary function of **connective tissue** is to connect muscle to bones and to connect joints together. Consisting of fiber called collagen, mature connective tissues have fewer cells than other tissues do and therefore need (and receive) less blood, oxygen, and other nutrients than other tissues.

Connective Tissue: The primary function of connective tissue is to connect muscle to bones and to connect joints together.

The positive effects of exercise on connective tissue have been well documented. Physical training has been shown to cause an increase in tensile strength, size, and resistance to injury along with the ability to repair damaged ligaments and tendons to regular tensile strength.

Tendons: Tendons are extensions of the muscle fibers that connect muscle to bone.

TENDONS

Tendons are extensions of the muscle fibers that connect muscle to bone. They are slightly more pliable than ligaments are but cannot shorten as muscles do. Various proprioceptors, the sensory organs found in muscles and tendons, provide information about body movement and position, and they protect muscle and connective tissue.

The Golgi tendon organ is embedded in tendon tissue and can be thought of as a safety valve. Increasing levels of muscular contraction result in feedback to the nervous system from the Golgi tendon organ.

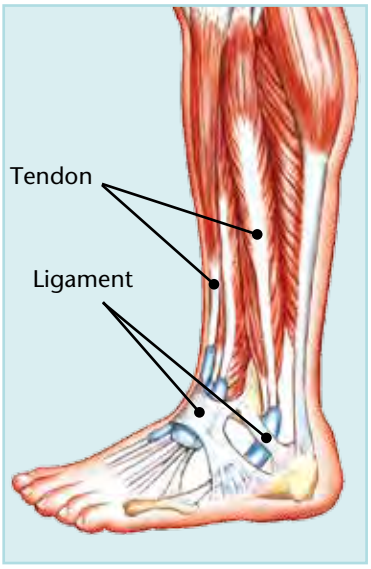


Figure 1.6 Tendons and ligaments

When tension becomes too great—greater than your brain can handle—this feedback inhibits the contraction stimulus, thereby reducing the likelihood of injury. This protective response is called the feedback loop.

Though this may sound debilitating to the intense weight trainer, there is some good news: training with high-speed contractions and with bands and chains can train you to somewhat inhibit the response of the Golgi tendon organ.

Ligaments: Ligaments connect bones to bones at a joint and, along with collagen, contain a somewhat elastic fiber called elastin.

LIGAMENTS

Ligaments connect bones to bones at a joint and, along with collagen, contain a somewhat elastic fiber called elastin. Although ligaments must have some elasticity to allow for joint movement, this elasticity is limited.

Cartilage: Cartilage is a firm, elastic, flexible white material. It is found at the ends of ribs, between vertebral discs, at joint surfaces, and in the nose and ears.

CARTILAGE

Cartilage is a firm, elastic, flexible white material. It is found at the ends of ribs, between vertebral

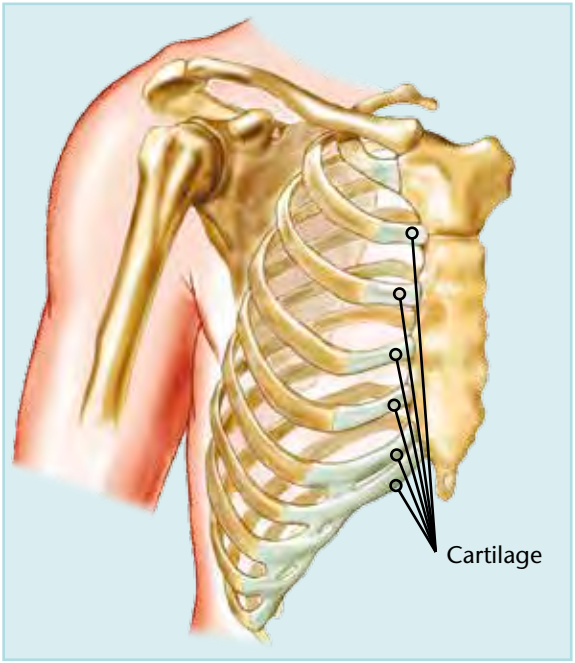


Figure 1.7 Cartilage

discs, at joint surfaces, and in the nose and ears. As a smooth surface between adjacent bones, cartilage provides both shock absorption and structure. It also lubricates the working parts of a joint.

Unlike tendons and ligaments, cartilage has no blood supply of its own. The only way for cartilage to receive oxygen and nutrients is through synovial fluid. Because of this lack of nutrients, damaged cartilage heals extremely slowly.

NERVOUS SYSTEM: THE MIND AND BODY LINK

Your nervous system is composed of two major parts. The **central nervous system** (CNS) consists of your brain and your spinal column. You should think of these two as an integrated unit, not as separate entities.

Central Nervous System: The central nervous system (CNS) consists of your brain and your spinal column. The CNS receives messages and, after interpreting them, sends instructions back to the body.

The CNS receives messages and, after interpreting them, sends instructions back to the body. The **peripheral nervous system** (PNS) does two things: (a) It relays messages from the CNS to the body (the efferent system), and (b) it relays messages to the CNS (the afferent system) from the body. (For a deeper understanding of how Central and Peripheral fatigue affect your performance, study Unit 14.) The CNS does the following:

Peripheral Nervous System: The peripheral nervous system (PNS) does two things: (a) It relays messages from the CNS to the body (the efferent system), and (b) it relays messages to the CNS (the afferent system) from the body.

It senses changes inside and outside your body.

It interprets those changes.

It responds to the interpretations by initiating action in the form of muscular contractions or glandular secretions.

Obviously, the entire strength-training vernacular you've been exposed to over the years regarding the crucial link between your mind and your body all boils down to the fact that your central nervous system is linked to your peripheral nervous system.

THEORY OF NEUROMUSCULAR ACTIVITY

Now that you have a basic understanding of the neuromuscular system's structure and function, your next step is to understand exactly how it works.

One of the most important theories of neuromuscular activity, the sliding filament theory, was discussed earlier. Let's take a look at the other theories of neuromuscular activity.

"All or None" Theory: Each myofibril could be described as a fundamentalist in its functioning. It knows nothing less than total contraction, as it responds with an all-or-none reaction. A core point here is that a motor unit is either completely relaxed or fully contracted.

The "All or None" Theory

When a nerve carries an impulse of sufficient magnitude down to the muscle cells that compose the motor unit, the myofibrils do the only thing they know how to do—contract, or shorten.

Each myofibril could be described as a fundamentalist in its functioning. It knows nothing less than total contraction, as it responds with an all-or-none reaction. A crucial point here is that a motor unit is either completely relaxed or fully contracted.

Because muscle fiber (including its myofibrils) and the entire motor unit of which it is a part respond to a nerve stimulus with the all-or-none reaction, not all the motor units that compose a muscle are activated during any given movement.

This is why it is of paramount importance to hit muscles at different angles, speeds, and ranges of motion. Not only that, but doing the same movements habitually means becoming increasingly proficient at that movement, which is great for the strength athlete but which handicaps the potential of maximal muscle growth.

This means you are able to exercise a gradation of response by increasing or decreasing the amount of chemo-electrical impulse to the muscle. In other words, you are coordinated enough to produce sufficient force to lift a fork to your face or curl a heavy dumbbell. Being unable to control force production by lifting a fork to your face would invoke a bloody disaster.

Both are similar movements, but curling a fork involves only those motor units with a very low excitation threshold, whereas curling the dumbbell requires many more motor units. The principle that allows this to happen is known as the size principle.

The Size Principle of Fiber Recruitment

Size Principle of Fiber Recruitment: States that those fibers with a high level of reliability (slow-twitch fibers with the fewest motor units) will be recruited first, and those with lower levels of reliability (fast-twitch fibers with the greatest number of motor units) will be recruited last.

Force output of muscle is related to the stimulus it receives. Different muscle fibers have different liability to recruitment, with Type I fibers having the highest liability, Type IIa and IIc having a moderate liability, and Type IIx possessing a low level of liability.

The **size principle of fiber recruitment** (also called the Henneman principle) states that those fibers with a high level of reliability (slow-twitch fibers with the fewest motor units) will be recruited first, and those with lower levels of reliability (fast-twitch fibers with the greatest number of motor

units) will be recruited last. This is why you are able to eat using Type I fibers, allowing you to safely put your fork into your mouth.

To recap, Type I (slow-twitch) muscle fibers are smaller and more endurance based than Type II (fast-twitch) muscle fibers are. Type II muscle fibers begin to be recruited when you use more than 25% of your maximum strength. Although a one-repetition max in the squat may be performed slowly, you will still be using all of your fast-twitch muscle fibers along with your slow-twitch ones to move the heavy barbell on your back.

The Stretch Reflex

As a muscle is stretched, **muscle spindles** become activated, and the brain receives a message that tells the muscle to contract. A rapidly stretched muscle stores elastic-like energy and in turn initiates an involuntary reflex. This involuntary reflex is termed the **stretch reflex**, and when used properly, it can increase the force produced during a given movement.

Stretch Reflex: As a muscle is stretched, muscle spindles become activated, and the brain receives a message that tells the muscle to contract. A rapidly stretched muscle stores elastic-like energy; this stretch reflex sparks a quick contraction.

Muscle Spindles: Muscle spindles are sensory receptors within the belly of a muscle that primarily detect changes in the length of this muscle. They convey length information to the central nervous system via sensory neurons.

Take a look at a vertical jump from a held squat position compared with one in which the athlete rapidly drops his of her butt and reverses the action as fast as possible. Numerous studies confirm athletes can jump higher using a counter movement than from a squat position. This is because the stretch reflex is used during the counter movement jump. During this counter movement jump, tension is developed during the eccentric phase (the rapid drop of the buttocks). This stored energy created by the tension developed during the eccentric phase is then used to increase the force output in the subsequent concentric contraction (when hips and knees extend to launch the person into the air). It is for this reason that the mechanism by which the stretch reflex works is compared with the snapping of a rubber band.

For the bodybuilder, an example of the stretch reflex in action is aiding a lift like the bench press. A full range of motion bench press is much easier than is a dead bench press starting at chest level due to the contributions from the stretch reflex.

A more scientific look at the stretch reflex shows it is a built-in protective function of the neuromuscular system in the muscle spindle, a proprioceptor found in the bellies of muscle.

In contrast to the Golgi tendon organ, which is in series with the force

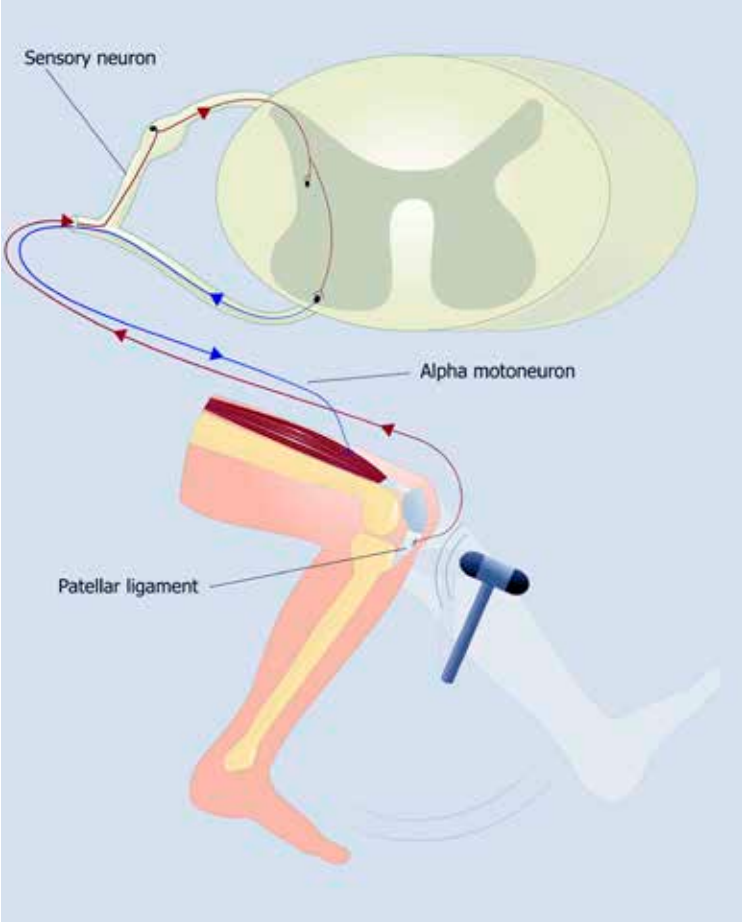


Figure 1.8 Knee jerk reaction

plane of the muscle, the muscle spindle is in parallel with the force plane. The action is similar to that of the Golgi tendon organ, in that it protects against overload and injury in what is known as the "stretch reflex" action (medical example: the knee-jerk response used by physicians to test your muscle's response adequacy).

NEURAL ADAPTATIONS

It is universally accepted that intense resistance training causes morphological changes to the physique by increased muscle mass. The question remains, can the nervous system be modified to your advantage?

The answer is yes, it can! Not only can you modify certain aspects of your nervous system function, but also the rewards in terms of training are significant.

The greatest advantages for the bodybuilder are improved strength output, better mental concentration, greater training intensity, pain management, and glandular secretions. All of these areas can be modified to at least a measurable degree and will aid you in your muscle-building quest.

Hypertrophy: Muscle hypertrophy involves an increase in size of skeletal muscle through a growth in size of its component cells.

HYPERTROPHY

Mechanical tension, muscle damage, and metabolic stress are the three factors that induce muscle **hypertrophy** from exercise, according to Brad Schoenfeld in The Journal of Strength and Conditioning Research. Mechanical tension is a product of intense resistance training and muscle stretch.

Muscle damage induces the delayed onset of muscle soreness that sets in approximately 24 hours after a workout and can peak two to three days after weight training. Metabolic stress results from the byproducts of anaerobic metabolism; this, in turn, promotes hormonal factors that induce hypertrophy.

"Everybody wants to be a bodybuilder but nobody wants to lift heavy-ass

weight. But I do," said Mr. Olympia Ronnie Coleman.

The human body desires to be in a state of stability known as homeostasis; when the state of stability is disrupted, adaptations occur.

This is how your muscles grow!

Resistance training places stress on muscles that they are not accustomed to; the response is increased growth "hypertrophy."

Research repeatedly has confirmed that heavy resistance training is the most beneficial method of achieving hypertrophy. The reason seems to be that the Type II fibers are most affected by heavy resistance training (as noted in the size principle) and ultimately have the greatest potential for growth.

That is why I recommend starting with powerlifting to build a base, just as Ronnie Coleman and "The Austrian Oak" did.

Muscle hypertrophy, to those outside of the iron game, sounds like useless scientific jargon, but to the bodybuilder, it's gospel.

What exactly is muscular hypertrophy?

It is the increase of the muscle's cross-sectional area, involving the concurrent increase in myofibrilar content (contractile element).

Myofibrilar hypertrophy results from lifting maximal weights for lower reps, the way that powerlifters train. Bodybuilders who train heavy have a very dense look.

If maximal muscularity is desired, there is no way around heavy core lifts.

Sarcoplasmic hypertrophy is the accumulation of noncontractile matter, such as water, glycogen, and myoglobin—which are stored in the sarcoplasm of the muscle cell—and the densification of mitochondrial content.

Sarcoplasmic hypertrophy, the result of high-volume training, typically associated with bodybuilders, is essential to maximizing your complete physique development. Typically, this type of training and the imposed adaptations do little to enhance limit strength. On the upside, strength endurance will improve because of mitochondrial hypertrophy.

Another benefit of training for sarcoplasmic hypertrophy is the growth and strengthening of connective tissues. The bodybuilder with the complete package will have a synergistic blend of both hypertrophic elements.

Initially, adaptations to resistance training will be neurological. In other words, by performing a movement, you become more coordinated at the movement technically. And by recruiting the right muscles to lift the weight, you become more efficient at the movement. As neurological adaptations start to slow, the muscle will start to grow.

We become stronger by enhanced neural patterns; as you continually overload your muscle, the cross-sectional muscle fiber area increases, and your muscles get bigger.

HYPERPLASIA

Hypertrophy is the accepted mechanism of increased mass. In essence, you are born with a certain number of muscle fibers; these can increase in size but not in number.

But what if the number of muscle fibers could increase?

During the late '60s and early '70s, European scientists discovered that the muscle cells of some animals adapted to severe overload by splitting

Hyperplasia: The enlargement of an organ or tissue caused by an increase in the reproduction rate of its cells.

Satellite Cells: Satellite cells serve to repair damaged muscle tissue, inducing muscle growth after overload from weight training.

in two. This response, called **hyperplasia**, was subsequently followed by an increase in muscle size. Muscle fibers divided and then multiplied, thus the potential implications to the bodybuilder are enormous.

Hang on. Hyperplasia in humans remains controversial. Studies on animals have shown mixed results.

Cats were trained to move a heavy weight with their paw to receive food; hyperplasia took place as a result. Other studies on animals counter these findings: Studies on chickens, rats, and mice found that muscle fibers increased in size but not in number; hyperplasia did not take place.

However, another study performed on birds showed an increase in the number of muscle fibers in their wings as a response to being chronically stretched by a weight's attachment on the wings. The cats were subjected to heavy resistance with lower repetitions; the other animals were involved in more endurance-based activities. This might explain some of the discrepancies in results.

According to world-renowned researcher Vladimir Zatsiorsky in his book Science and Practice of Strength Training, both hyperplasia and hypertrophy contribute to muscle size increases in humans. However, the contribution of fiber hyperplasia is rather small (less than 5%).

This may not sound like much, but in the pro ranks, this could potentially mean an additional inch on your arms! Research on hyperplasia in people is not vast, but some exists.

A 1978 study reported that muscle fiber size remained constant in swimmers, but the muscle increased in size.

Researchers Nygaard and Nielsen argued that increased muscle size was a result of hyperplasia. A 1986 examination of European bodybuilders showed an abnormally high muscle fiber density on the two subjects who had trained intensely with weights for 14 years or longer, whereas those who had trained for four to six years had more normal fiber density. The abnormal fiber density, researchers theorized, may have been a hyperplasic response to long-term extreme weight training.

Assuming hyperplasia can take place, it would happen through a few mechanisms, from what research has shown. This would mean performing movement with an extreme stretch. Examples are stiff leg deadlifts for hamstrings, sissy squats for quads, dumbbell flyes for chest, incline dumbbell curls (palms supinated the whole time) for biceps, French press for triceps, cable rows for back, and inclined lateral raises or front raises for shoulders. Of course, the list could go on. You will also need to lift

heavy. This means hitting the core lifts hard and, of course, long-term training. Holistic, intense, long-term training appears to be the best way to possibly induce hyperplasia.

SATELLITE CELLS

Satellite cells serve to repair damaged muscle tissue, inducing muscle growth after overload from weight training.

Satellite cells are the skeletal muscles' "stem cells." Overload from intense weight training causes trauma to the muscle. This disturbance to the muscle cell organelles activates satellite cells, which are located on the outside of the muscle cell, to proliferate at the site trauma was induced.

After satellite cells are damaged via intense resistance training, damaged muscle fibers are repaired by satellite cells' fusing together and to the muscle fibers, which leads to muscle growth. The satellite cells have only one nucleus and can replicate by dividing.

During the process of satellite cell multiplication, a small percentage of satellite cells remain as organelles on the muscle fibers. However, most will repair damaged muscle fibers or fuse to muscle fibers, forming new myofibrils. For the bodybuilder, this is exciting because the myofibrils of the muscle cell increase in number and size.

What does this mean?

After satellite cells fuse with muscle fibers, muscle fibers can synthesize more proteins and create a greater number of contractile proteins, meaning muscle will grow and get stronger.

Let's take a practical look at how you can take advantage of satellite cell proliferation.

A 2006 study in the The Journal of Physiology titled "Creatine Supplementation Augments the Increase in Satellite Cell and Myonuclei Number in Human Skeletal Muscle Induced by Strength Training" for the first time showed that creatine supplementation in conjunction with strength training amplified the effects of strength-training-induced increases in satellite cell number and myonuclei concentration in human skeletal muscle fibers—enhancing muscle fiber growth in response to strength training.

"The Effects of Eccentric Versus Concentric Resistance Training on Muscle Strength and Mass in Healthy Adults: A Systematic Review with Meta-Analysis" was published in 2009 in the British Journal of Sports Medicine, showing intense eccentric contractions were superior to concentric patterns for increasing muscle size. This is not a surprise, because intense eccentric movements force muscle fibers and surrounding satellite cells to fuse, resulting in muscle fiber growth.

For you to maximize muscle growth, intense eccentric movements will need to be a part of your regimen. Remember, these induce a greater delayed onset of muscle soreness (DOMS) and should not be a part of a deload ever.

IGF-1 is largely responsible for satellite cell proliferation, and that would explain why some bodybuilders are willing to illegally supplement with it.

A 2003 study in the American Journal of Physiology, Endocrinology, and Metabolism titled "Testosterone-Induced Muscle Hypertrophy Is Associated with an Increase in Satellite Cell Number in Healthy, Young Men" examined satellite cell proliferation on subjects who used 125 mgs, 300 mgs, and 600 mgs weekly of synthetic testosterone, along with a baseline group that did not use any synthetic hormone assistance. The groups using 300 and 600 mgs of testosterone

weekly had significant increases in the number of satellite cells; the baseline and the 125 mg group did not.

Although I do strongly discourage any illegal drug use, I believe in presenting facts.

A FEW LAST WORDS

Fast-twitch muscle fibers have the highest potential for growth. This means that to get bigger muscles, you have to get stronger ones, especially as your muscle-building journey commences.

Your limit strength, as will be discussed in great detail throughout the text, is your base.

Heavy resistance training augments your being able to efficiently recruit the largest high-threshold motor units. The greater number of motor units recruited, the more that muscle fibers are stimulated. The highest motor unit stimulation stems from using heavy weights, so you are going to need to train heavy.

This all sounds great, but why do the strongest powerlifters in the world have less muscle than bodybuilders who are much weaker do?

Powerlifters generally train only in low-rep ranges, enhancing myofibrilar hypertrophy.

The bodybuilder needs to take a holistic approach, developing all components of the muscle. This is done by taking a holistic approach with high reps, low reps, high speed, low speed, compound movement, eccentrics, stretch movements, peak contraction, and time under tension: it's a balancing act to maximize hypertrophy. Later units in this book will be devoted to helping you understand how to balance these training variables to elicit optimal results.

TOPICS COVERED IN THIS UNIT

Introduction

Fundamental Movements of Major Body Segments

Movement Planes and Axes

Musculoskeletal Movement

- Mechanical and Physiological Advantage
- The Role of Muscles during Movement
- Initiating and Sustaining Movement

The Principle of Levers

Newton's Laws of Motion

- Force

UNIT 2

BASIC KINESIOLOGY AND BIOMECHANICS

INTRODUCTION

Kinesiology is the study of human movement. Biomechanics is the science that examines the internal and external forces acting on the body and the effects these forces produce. Within this framework, there are two situations: static and dynamic.

In a static situation, forces acting on the body are balanced, or in equilibrium, and there is no movement. Such is the case in isometric training. In the weight room, some examples include pushing against an immovable object or statically holding a barbell, dumbbell, or machine in place.

As a bodybuilder, when you hold a pose, you are isometrically contracting your muscles. All other situations are dynamic, meaning the forces acting on the body are not in equilibrium, setting the body into motion. Motion occurs when the force that muscles or motion generates is greater than the resistance it encounters is, or vice versa.

Clearly, most situations that occur in resistive training are dynamic. Just as every muscle has a definable action on the joint it crosses, clear principles of physics are easily brought to bear in the study of human movement. It is important to realize that isometrics can help gain minimal amounts of muscle and limit strength within a 15-degree range of motion of where the isometric contraction is taking place. Dynamic contractions overall are much more efficient for gaining strength and size.

You should be concerned not only with the technique of the various movements but also with the effect these movements have upon your posture, body mechanics, and musculature.

Regardless of your motivation (improving physique, strength, endurance, or muscle tone), the biomechanical principles behind sports training apply equally in every training situation. Knowledge of biomechanics is critical.

FUNDAMENTAL MOVEMENTS OF MAJOR BODY SEGMENTS

Six primary movements occur at the joints between the body segments. They include flexion, extension, abduction, adduction, rotation, and circumduction.

Flexion: A decrease in the angle between two body segments.

- **Flexion** is a decrease in the angle between two body segments. Flexion can be readily seen at the shoulder, elbow, hip, and knee joints. For example, on the arm curl machine, flexion occurs at the elbow. Special flexions occur at the trunk (lateral flexion, or bending

sideways), the wrist (ulnar flexion, or bending toward the pinky side of the hand; and radial flexion, or bending toward the thumb side), and the ankle (dorsi flexion, or toes up; and plantar flexion, or toes down).

- **Extension** is an increase in the angle between two body segments, or simply the return from flexion. For example, on the leg extension machine, extension occurs at the knee.
- **Hyperextension** is the increase in the angle beyond the anatomical point of normal joint movement. Examples of hyperextension are the shoulder joint during the backswing in bowling, in jiu-jitsu an arm bar; the neck in a neck bridge in wrestling, and the hip joint on the standing hip machine when the leg is lifted behind the body.
- **Abduction** is the movement of a body segment away from the midline. Examples include the arm movement of a starter holding the gun in track, spreading of the fingers or toes, or the legs moving apart on a hip abductor machine or the lateral raises.
- **Adduction** is the movement of a body segment toward the midline, or simply the return from abduction, as in the legs coming together on a hip adductor machine or squeezing together dumbbells when performing a flye.
- **Rotation** is the circular movement of a body segment about a long axis.
- **Inward rotation** occurs when a body segment moves toward the midline (the upper arm when throwing a screwball).
- **Outward rotation** occurs when a body segment moves away from the midline (the upper arm in a backhand tennis stroke).
- **Right and left rotation** defines the directional rotation of the head or trunk. Special rotations occur at the forearm and feet.
- **Pronation** is the rotation of the forearm to the palms-down position (as in a basketball dribble or on the seated chest press machine).
- **Supination** is the rotation of the forearm segment to the palms-up position (as in doing a standard curl on the arm curl machine.
- **Eversion** (also called pronation) is the outward lifting of the lateral aspect of the foot.
- **Inversion** (also called supination) is the inward lifting of the medial portion of the foot, a common cause of ankle injuries.
- **Circumduction** is the sequential combination of movements outlining a geometric cone. Examples include circles of the trunk, shoulder, hip, ankle, and thumb.

Extension: An increase in the angle between two body segments, or simply the return from flexion.

Hyperextension: The increase in the angle beyond the anatomical point of normal joint movement.

Abduction: The movement of a body segment away from the midline.

Adduction: The movement of a body segment toward the midline

Rotation: The circular movement of a body segment about a long axis.

Inward Rotation: Occurs when a body segment moves toward the midline.

Outward Rotation: Occurs when a body segment moves away from the midline.

Right and Left Rotation: Defines the directional rotation of the head or trunk.

Pronation: The rotation of the forearm to the palms-down position (as in a basketball dribble or on the seated chest press machine).

Supination: The rotation of the forearm segment to the palms-up position (as in doing a standard curl on the arm curl machine).

Eversion: The outward lifting of the lateral aspect of the foot.

Inversion: The inward lifting of the medial portion of the foot, a common cause of ankle injuries.

Circumduction: The sequential combination of movements outlining a geometric cone.

Table 2.1: Major Muscles and Their Actions	
Shoulder Girdle	
Trapezius - Upper	scapula elevation and extension of the head at neck
Trapezius - Middle	elevation, upward rotation and adduction of scapula
Trapezius - Lower	depression adduction, upward rotation of the scapula
Levator scapulae	elevates medial margin of scapulae
Rhomboid	(retraction) draw scapula toward spinal column (downward rotation) (elevation)
Serratus anterior	(protraction) draws medial border of scapulae away from vertebrae (upward rotation)
Pectoralis minor	(protraction) draws scapula forward (downward rotation) (depression)
Shoulder Joint	
Deltoid - Anterior	abduction, flexion, horizontal adduction, and internal rotation of glenohumeral joint
Deltoid - Middle	abduction of the glenohumeral joint
Deltoid - Posterior	abduction, extension, horizontal abduction, and external rotation of glenohumeral joint
Coraco-brachialis	flexion, adduction, and horizontal adduction of glenohumeral joint
Supraspinatus	weak abduction and stabilization of humeral head in glenoid fossa
Infraspinatus	external rotation, horizontal abduction, and extension of the glenohumeral joint, stabilization of humeral head in glenoid fossa
Teres minor	external rotation, horizontal abduction, and extension of glenohumeral joint; stabilization of humeral head in glenoid fossa
Subscapularis	internal rotation, adduction, and extension of glenohumeral joint; stabilizes humeral head in glenoid fossa
Teres major	extension, internal rotation, and adduction of glenohumeral joint
Latissimus dorsi	addition, extension, and internal rotation of glenohumeral joint; horizontal abduction of glenohumeral joint
Pectoralis major - Clavicular	internal rotation, horizontal adduction, flexion abduction, and adduction (when the arm is 90° of abduction of the glenohumeral joint
Pectoralis major - Sternal	internal rotation, horizontal adduction, extension, and adduction of the glenohumeral joint
Elbow and Radioulnar Joint	
Biceps brachii	flexion of elbow, supination of forearm, weak flexion shoulder joint
Brachialis	flexion of elbow
Brachioradialis	flexion of elbow, pronation from supinated to neutral position, supination from pronation to neutral position
Triceps brachii	extension of the elbow
Triceps brachii - Long Head	adduction of the shoulder joint, extension of elbow
Anconeus	extension of the elbow
Hip Joint and Pelvic Girdle	
Rectus Femoris	flexion of hip, extension of knee
Gluteus maximus	Extension of hip, external rotation of hip, lower fibers which assist in adduction
Semitendinosus	Extension of hip, flexion of knee, internal rotation of hip and knee
Semi-membranosus	Extension of hip, flexion of knee, internal rotation of hip and knee
Biceps femoris	Extension of hip, flexion of knee, internal rotation of hip and knee
Knee Joint	
Vastus lateralis	Knee extension
Vastus intermedius	Knee extension
Vastus medialis	Knee extension
Ankle and Foot	
Gastrocnemius	Plantar flexion of the ankle, flexion of the knee
Soleus	Plantar flexion of the ankle
Tibialis anterior	Dorsal flexion of ankle, inversion of foot
Trunk and Spinal Column	
Rectus abdominis	Depresses ribs, flexes vertebral column
Transversus abdominis	Compresses abdomen
External oblique	Compresses abdomen; depresses ribs; flexes, bends to side, or rotates spine
Internal oblique	Compresses abdomen; depresses ribs; flexes, bends to side, or rotates spine

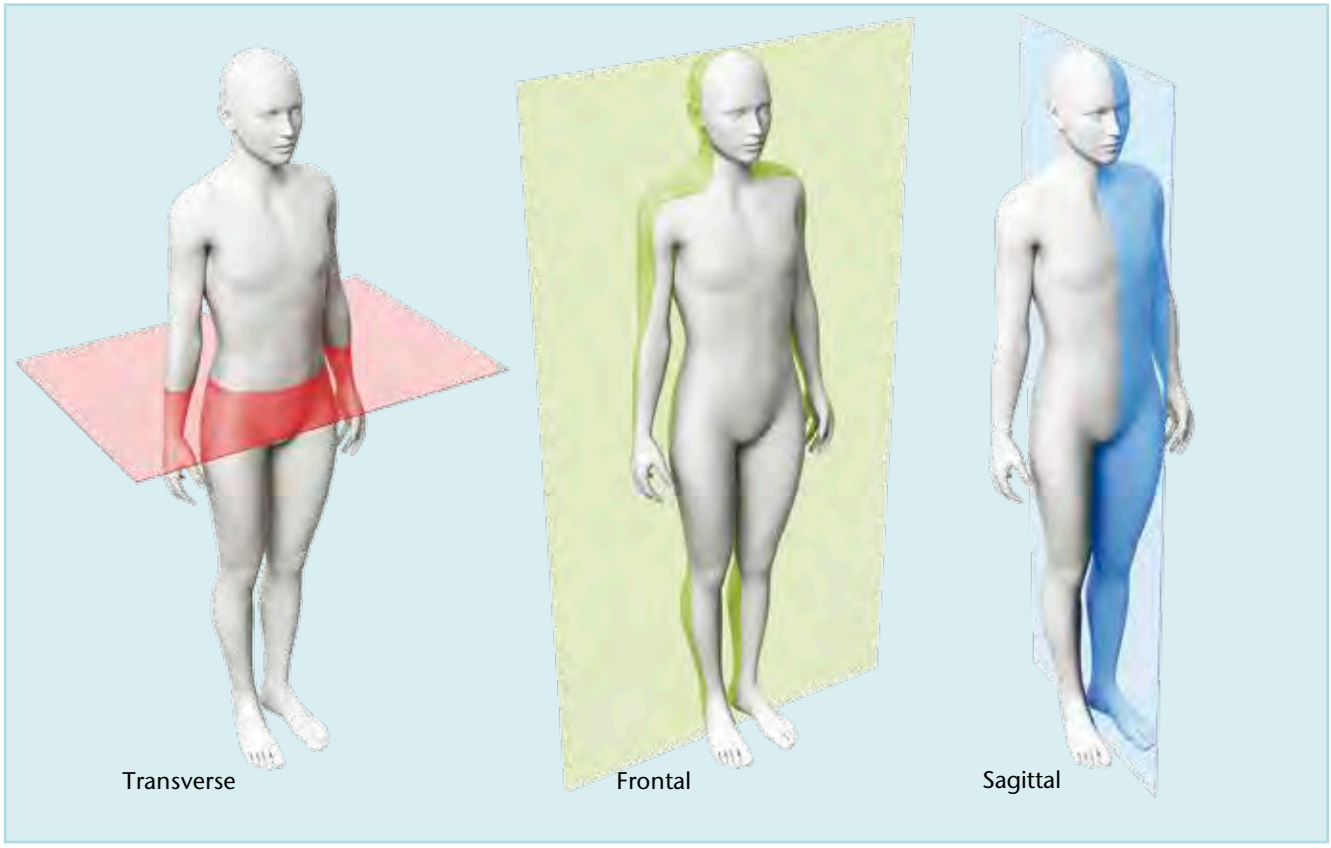


Figure 2.1 Planes of motion

MOVEMENT PLANES AND AXES

A **plane** is a flat surface. Three imaginary planes pass through the human body. Each plane is perpendicular to each of the other two. In addition, there are three axes around which movement occurs, each perpendicular to the plane of the movement. These planes and axes are diagrammed in Figure 2.1.

The **sagittal (anteroposterior) plane** is a vertical plane passing through the body from front to back, dividing the body into left and right portions. The sagittal plane is intersected by the transverse (Y) axis.

The **frontal (coronal) plane** is a vertical plane passing through the body from left to right, dividing it into front and back portions. The frontal plane is intersected by the medial (X) axis.

The **horizontal (transverse) plane** passes through the body in a line parallel to the ground, dividing the body into upper and lower portions.

Plane: A plane is a flat surface. Three imaginary planes pass through the human body. Each plane is perpendicular to each of the other two.

Sagittal Plane: A vertical plane passing through the body from front to back, dividing the body into left and right portions.

Frontal Plane: A vertical plane passing through the body from left to right, dividing it into front and back portions.

Horizontal Plane: Passes through the body in a line parallel to the ground, dividing the body into upper and lower portions.

The horizontal plane is intersected by the longitudinal (Z) axis. Human movements are commonly described in terms of the planes they occupy.

Two examples that may help describe the orientation of movement are given here.

The first is a typical biceps curl. Concentric contraction of the biceps occurs in the sagittal plane about the transverse axis.

The second one is abduction of the arm, as in raising a gun to start a race, and occurs in the frontal plane about the medial axis.

The standardized reference position from which movements of the body are described is the anatomical position, in which the body is facing forward, arms at the sides and palms forward.

MUSCULOSKELETAL MOVEMENT

The adage, "You can't get something for nothing" holds true when it comes to the mechanical design of the body. The human body has compromised strength for speed and range of motion.

One way the body overcomes this inherent weakness is to incorporate a group of muscles for a particular action. These muscles can be single-joint, two-joint, or multi-joint muscles, acting at the joint they span.

A single-joint muscle acts on one joint; for example, the brachioradialis flexes the elbow joint. A two-joint muscle acts on two joints; for example, the rectus femoris flexes the hip joint and extends the knee joint. A multi-joint muscle acts on more than two joints, for example, the flexors and extensors of the wrists and fingers.

MECHANICAL AND PHYSIOLOGICAL ADVANTAGE

Mechanical Advantage of a Muscle: The amount of resistance overcome in proportion to the amount of effort expended.

The **mechanical advantage** of a muscle refers to the amount of resistance overcome in proportion to the amount of effort expended. The mechanical advantage of a muscle is greatest when the angle of pull is 90 degrees. The angle of the pull of a muscle is the angle formed between the long axis of the bone being moved and the line of pull of the contracting muscle.

Physiological Advantage of a Muscle: The ability of a muscle to shorten.

As the angle of pull deviates from 90 degrees, the mechanical advantage decreases. At zero degrees of muscle pull, the mechanical advantage of the muscle is zero, while the **physiological advantage** is the highest. The physiological advantage refers to the ability of a muscle to shorten.

This can be increased by applying an initial stretch, or preload, to the muscle. This is because at slightly beyond its initial length, a muscle possesses its greatest physiological advantage. This why you can bench press more on a traditional bench press than via a dead bench press performed from a bottom-up, dead-start position in the rack.

Another familiar mechanical and physiological example is the arm curl machine. When the arm is fully extended at the start of the curl, physiological advantage is greatest, and mechanical advantage is at its least. Midway through the curl, when the angle between the upper arm and the forearm is 90 degrees, mechanical advantage is highest, whereas physiological advantage has decreased.

At the end of the curl, when the upper arm and the forearm are actually touching, mechanical advantage has decreased, and physiological advantage is at its lowest.

THE ROLE OF MUSCLES DURING MOVEMENT

A muscle can perform only one of six roles during a particular movement at a given joint. These roles include: Prime Mover (Agonist), Assistant Mover, Antagonist, Stabilizer, Helping Synergist, and True Synergist.

A **prime mover** is the muscle that produces the most force to move a bone. Most two-joint muscles are prime movers of the distal (farther from the center of the body) joint spanned.

An **assistant mover** is a muscle that assists a prime mover in overcoming resistance. An example would be extending the hips: The prime mover is the glutes, and the hamstrings are assistant movers; think of locking out a deadlift and pushing your hips through. Most two-joint muscles are assistant movers of the proximal (closer to the center of the body) joint spanned.

A muscle is **antagonistic** when it acts in opposition to the movement occurring at the joint (the triceps during elbow flexion).

A muscle plays the role of a **stabilizer** when it stabilizes or fixes a bone so that movement can occur at another bone articulating with the stabilized bone. For example, the rectus abdominus contracts isometrically in a leg lift to stabilize the pelvis and to keep it from tilting forward.

Two muscles are **helping synergists** when they cancel each other's normal movement, allowing the desired movement to occur.

The role of a **true synergist**, however, is to cancel the undesired

Prime Mover: The muscle that produces the most force to move a bone.

Assistant Mover: A muscle that assists a prime mover in overcoming resistance.

Antagonistic Muscle: A muscle that acts in opposition to the movement occurring at the joint.

Stabilizer Muscle: When a muscle stabilizes or fixes a bone so that movement can occur at another bone articulating with the stabilized bone.

Helping Synergists: Two muscles are helping synergists when they cancel each other's normal movement, allowing the desired movement to occur.

True Synergists: The role of a true synergist is to cancel the undesired movement of a prime mover while not participating in the desired movement.

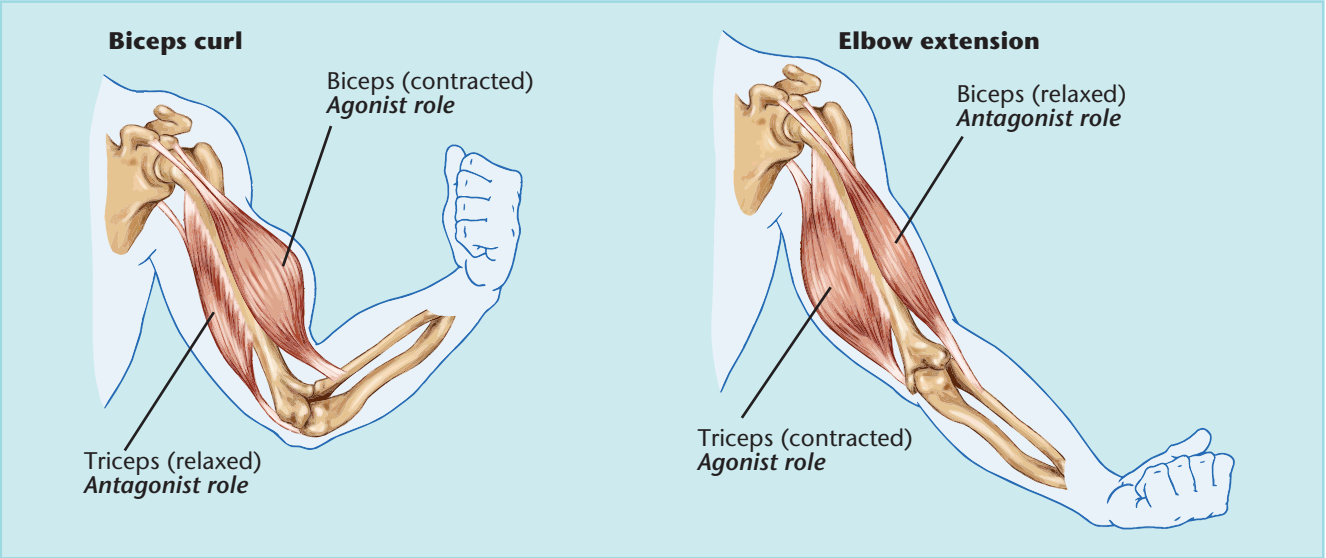


Figure 2.2 Muscle roles: agonist and antagonist

movement of a prime mover while not participating in the desired movement.

INITIATING AND SUSTAINING MOVEMENT

To begin a movement, a force must be produced within the body to overcome inertia. The force, which typically overcomes inertia, is provided by muscular contractions. The amount of force that can be generated by the muscle results from an interplay of many factors, not the least of which is sheer muscle size—the contracting muscle's cross-sectional area. The desired movement is the result of the summation of forces produced by the muscles' acting as prime movers, helping synergists and true synergists.

Origin: The origin (proximal attachment) of a muscle is referred to as the fixed point and is toward the center of the body.

Insertion: The insertion (distal attachment) of a muscle is referred to as the moving point and is away from the body.

Functional reversibility: muscles may pull from either direction

The **origin** (proximal attachment) of a muscle is referred to as the fixed point and is toward the center of the body. The **insertion** (distal attachment) of a muscle is referred to as the moving point and is away from the body. Although the reference to origin and insertion indicates that they are always a fixed point and a moving point, respectively, there are instances when this is not the case.

Functional reversibility refers to the concept that muscles may pull from either direction. That is, in some movements, the roles are reversed, which causes the origin to become the moving point and the insertion to become the fixed point.

One example is the biceps muscle during a curl and a chin-up. In the curl, the biceps origin (fixed point) is at the shoulder, and the insertion

(moving point) is at the elbow. When a chin-up is performed, the fixed point is the elbow, and the moving point is the shoulder.

THE PRINCIPLE OF LEVERS

A lever is a bar or some other rigid object, hinged at one point, to which forces are applied at two other points. The fulcrum is the hinge, or pivot point, of the lever.

There are three classes of levers (Figure 2.3), and all are involved in human movement.

A **first-class lever** has its fulcrum at a point between the resistance and the force (as in a seesaw). This lever involves the two ends of the lever moving in opposite directions; the triceps is an example. Such levers usually sacrifice force production for speed.

First-Class Lever: Has its fulcrum at a point between the resistance and the force (as in a seesaw).

A **second-class lever** has its resistance at a point between the force and the fulcrum (as in a wheelbarrow). These types of levers produce a great amount of force at the expense of speed. Second-class levers are extremely rare in the human body; opening the mouth against resistance is one of the few examples.

Second-Class Lever: Has its resistance at a point between the force and the fulcrum (as in a wheelbarrow).

A **third-class lever** has its force at a point between the resistance and the fulcrum (as in a shovel). This is the most common lever in the body. The arrangement of the lever allows for speed over distance, with a small sacrifice made in force production. The biceps is a prime example of a third-class lever.

Third-Class Lever - Has its force at a point between the resistance and the fulcrum (as in a shovel). This is the most common lever in the body.

Every movement of the body involves leverage. The joint (fulcrum) is the fixed axis about which angular motion occurs. The contracting muscle provides the force to move the bone. The resistance is the weight of the body segment, gravity and, in the case of sports training, the resistance of the training device.

The various classes of levers provide for an increase or decrease in speed, force, and range of motion. A decrease in one of the factors results in an increase in either one or both of the other factors.

A lever will balance when the resistance equals the force, resulting in isometric contraction (or static contraction). Movement of a body segment occurs when the lever becomes unbalanced, in favor of either force (muscular concentric contraction) or resistance (muscular eccentric contraction).

The seated chest press is an example of this concept. For the athlete to

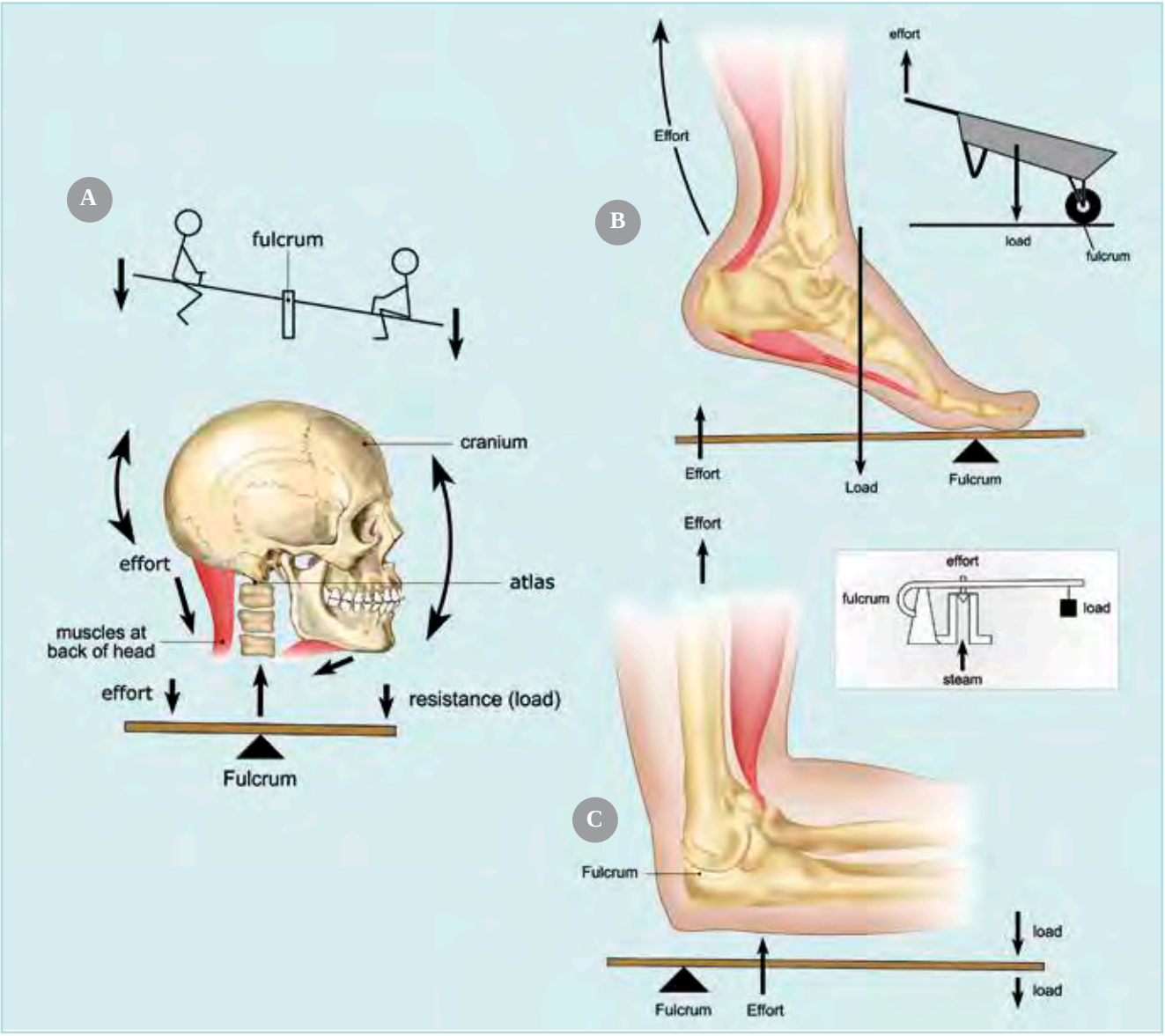


Figure 2.3 (A) First-class lever. An example is nodding your head. This lever works like a teeter-totter. (B) Second-class lever. This lever works like a wheelbarrow. When going up on your toes, this lever system allows you to lift your body weight with very little effort. (C) Third-class lever. This lever works like a piston in an engine.

be able to push the handles away from the chest, the force (muscular strength) must exceed the resistance (weight, air pressure, or other resistance-generating technology of the training apparatus).

The force generated by the contraction of muscle or by gravity (resistance) is divided into two components: rotatory and non-rotatory. Rotatory (vertical) components of muscle contraction and resistance produce movement about the joints. Non-rotatory (horizontal) components of resistance dislocate the joint, whereas non-rotatory components of contraction stabilize the joint.

The angle of pull of a muscle changes as movement occurs in the joint. This change in angle has a direct effect on the muscle's pulling force in

moving the bone. At 90 degrees or more, all the pull is rotary. When the angle decreases from 90 degrees, at least some non-rotary (stationary) involvement exists.

The angle of pull of most muscles in the resting position is less than 90 degrees and usually remains there throughout most movements. At 45 degrees, the force is divided equally between the rotary and non-rotary components.

For the majority of muscles, the angle of pull remains less than 45 degrees, with more of the muscle's force stabilizing the joint than moving the lever (body segment).

NEWTON'S LAWS OF MOTION

Isaac Newton discovered several principles that can be directly applied to kinesiology. The following summarizes these laws.

Newton's First Law of Motion: The Law of Inertia, states that a body will remain at rest or in motion until acted upon by an outside force. The heavier the body, the more force it takes to overcome inertia and set the body in motion. Likewise, a heavy body would require more force to stop it than a lighter body would.

The Law of Inertia: States that a body will remain at rest or in motion until acted on by an outside force.

Newton's Second Law of Motion: The Law of Acceleration, states that the acceleration of an object is proportional to the force causing it and is in the same direction as that force. This law is usually applied to free-falling objects in reference to the effects of gravity.

The Law of Acceleration: States that the acceleration of an object is proportional to the force causing it and is in the same direction as that force.

Newton's Third Law of Motion: The Law of Action-Reaction, states that for every action (force) there is an equal and opposite reaction (force). For example, when a swimmer pushes against the water, the water provides the reactive force necessary to propel the swimmer forward.

The Law of Action-Reaction: States that for every action (force) there is an equal and opposite reaction (force).

FORCE

Force is defined as mass times acceleration (F = ma). How a force affects a body is determined by the size or magnitude of the force, the direction in which the force is applied, and the exact point at which the force is applied to the object. A change in one component may dramatically alter the nature of motion.

Force: Mass times acceleration (F = ma).

For example, two 75-pound forces applied in the same direction at the center of the object will result in linear motion. However, no motion will occur if the two 75-pound forces act in opposite directions.

If you put 300 pounds of force in the barbell on the bench press and the barbell weighs 300 pounds, it will not move! This is essentially why you can get stronger using submaximal weights, even if a barbell weighs 225 pounds, you can still lift it with 300 pounds of maximal force; this concept is called Compensatory Acceleration Training, and it is discussed throughout the course.

Magnitude, direction, and point of application relate to both the external force of gravity and the internal muscular force, as described below.

The force of gravity is the external force, which the human body must constantly overcome in its movements. The force of gravity gives weight to a body and is measured in terms of the body's weight.

When a person holds a 30-pound dumbbell, the pull of gravity is felt as the weight of the dumbbell. The dumbbell will stay in the hand as long as the person applies an equal and opposite muscular force that balances the downward gravitational pull.

When the muscle is relaxed, the dumbbell drops, and the pull of gravity becomes apparent. The weight of the dumbbell is the magnitude of the force of gravity acting on the dumbbell. The magnitude of muscular force is in direct proportion to the number and size of the muscle fibers in the contracting muscle.

The point of application of muscular force is the center of the muscle's attachment to the bone. The mechanical axis of a bone or body segment is a straight line that connects the midpoint of the joint at one end with the midpoint of the joint at the other end.

The direction of muscular force is identified by the muscle's line of pull and the portion of the mechanical axis that lies between the point of application and the fulcrum.

Force is an important component in bodybuilding and strength training. Force is a variable in the definition of "strength" as well as "power"—both concepts are important to understand to maximize your adaptations to training.

Power is defined as force times distance divided by time ($P = fd/t$). Strength (your base) is the ability to contract your muscles with maximum force, given constraints stemming from structural/anatomical factors, physiological/biochemical factors, psychoneural/psychosocial factors, and external/environmental factors.

A FEW LAST WORDS

Continue to review the terminology and concepts discussed in this unit, as they will be referenced in your future academic and professional endeavors. By having a basic understanding of the principles of kinesiology and biomechanics, you will be able to assess the movement patterns and the mechanical factors that affect the overall performance of the bodybuilding athletes that you train, thereby allowing you to develop safer and more effective training programs.

TOPICS COVERED IN THIS UNIT

Get Big: Train Big Lifts

- Limit Strength
- The Squat
- The Overhead Press
- Chin-ups
- The Bench Press
- The Deadlift
- Bar Dips

Hormonal Response to Heavy Core Lifts

A Few Last Words

UNIT 3

BACK TO BASICS

When a company becomes institutionalized and loses sight of the values spawned in its genesis, oftentimes the solution is to return to the original mission statement.

Similarly, when bodybuilders train light using single-joint isolation movements, taking the path of least resistance, and they find themselves not growing or becoming stronger, the situation calls for going back to the basics; we are talking heavy pig iron.

Remember, in the pre-steroid era through the steroid-only era of the 1950s to the early 1980s, before the arrival of synthetic growth hormone and other drugs, most bodybuilders (champion and gym rat alike) with great physiques realized that building strength with basic, compound, multi-joint lifts was the key to size, strength, power, and symmetry.

What has changed? Why do many current bodybuilders not adhere to these time-tested truths?

One reason could be that massive amounts of anabolic agents such as growth hormone, IGF-1, Insulin, SARMS, and other strange anabolic agents stacked with absurd amounts of steroids have allowed people to get away with unsound training practices.

Case in point: I have seen some good bodybuilders do a routine for their backs that solely consisted of:

- Light Lat Pull-downs
- Cable Rows
- Machine-Assisted Chin-ups

The combination of great genetics and playing Russian roulette with a massive amount of muscle-building drugs is the only way that this aforementioned style of training would build a massive, muscular championship physique.

Just think what would happen if that same bodybuilder used heavy compound movements with the right synergistic blend of single-joint movements and properly periodized the training: A great champion would be in the making! I see it repeatedly.

A workout example of such an approach would consist of the following:

- Deadlifts
- Various Grip Chin-up Variations
- Peak Contraction Band Resisted T-Bar Rows
- Meadows Rows/One-Armed Dumbbell Rows Superset
- Chest-up Face Away Tempo/Time Under Tension Wide Grip Lat Pull-downs
- Tempo One-Armed Cable Low Rows

Look at the work accomplished here: a heavy compound movement, a peak contraction movement, big movements, small movements, and time under tension are all at the core of the program.

This post-exhaustion/powerbuilding style of training does not ignore any of the holistic components of maximizing muscle growth and carving a competition-ready symmetrical physique.

Bodybuilders who ignore the most important part of their training, compound movements, falsely believe their muscular physiques are a product of *sound* training. Yet the truth is, it's because of great genetics and great drugs.

If you can train like the first bodybuilder I spoke of does and you happen to be big and muscular, you have great genetics. Now, just think of the amazing metamorphosis that would take place if you trained as the second bodybuilder does. Not only would you experience greater internal satisfaction, you would start bringing home the hardware at bodybuilding contests.

GET BIG: **TRAIN BIG LIFTS**

To get big and strong, you need to keep big compound movements at the core of your program.

For back development, deadlifts beat lat pull-downs. For chest and triceps, weighted dips take precedence over a cable movement. For shoulders standing presses beat out machine lateral raises, and front squats are superior to leg extensions for quadriceps development.

Remember, a great bodybuilding program will have both compound (multi-joint) movements and isolation (single-joint) movements. The key is integrating both to play in concert like a fine orchestra. If we had to choose, we would choose big lifts over small isolation ones…luckily, we do not have to choose!

LIMIT STRENGTH

Limit strength is the ability to produce maximum force voluntarily in a given action. In other words, it's how much force you can produce in one all-out effort, regardless of time. Powerlifting is the best example of a limit-strength test.

Limit Strength: Limit strength is the ability to produce maximum force voluntarily in a given action.

Eccentric Strength: The amount of weight you can lower without losing control.

Static Strength: The amount of weight you can hold stationary without losing control.

Concentric Strength: The amount of weight you can lift one time with an all-out muscle contraction.

There are three kinds of limit strength:

1. **Eccentric strength**—how much weight you can lower without losing control
2. **Static strength**—how much weight you can hold stationary without losing control
3. **Concentric strength**—how much weight you can lift one time with an all-out muscle contraction

"Wait," I hear the chorus echoing. "I am a bodybuilder. Limit strength is not important."

To that, folks, I say "Hogwash!"

Limit strength in all athletic endeavors is your foundation and could, in fact, be labeled foundational strength.

Think about this logically.

If you can front squat 450 pounds, you will be able to do more one leg extensions than if your max front squat is 200 pounds.

If you can bench press 400 pounds, you will do more with cable flyes than if your max bench press is 200 pounds.

Think about all the various components of the holistic approach of muscle building—high reps, low reps, and time under tension.

Whether it's the principle of isolation or forced reps, you will do more if you are stronger; this in turn is a catalyst for maximizing muscle growth.

Let's return to the bench press. If your one-repetition max is 400 pounds, 200 pounds is only 50% of your max; you can do much more with those 200 pounds than if your max is 250 pounds.

Remember, your limit strength is your base.

It's time to heed Dr. Fred Hatfield's wisdom and to realize you cannot shoot a cannon out of a canoe; you must shoot it from a sturdy foundation. Start building your base now if you want to build your best physique for the international stage or simply because you want it.

Generally, limit strength is best increased for advanced bodybuilders using more than 85% of their one-repetition maximum. Beginners can literally increase limit strength with less than 50% of their one-repetition max. Training heavy compound movements develops limit strength.

Here are some core lifts that can help pave the way for your bodybuilding success.

THE SQUAT

Former Mr. Olympia Jay Cutler had this to say about squats in the March 2004 edition of *Flex* Magazine: "Nothing builds quad mass like heavy free weight squats. I recommend all bodybuilders squat."

An array of variations of squat movements is highly beneficial to the bodybuilder. Though squatting is a compound movement, meaning multiple joints and muscles are used, it is

possible to put a greater emphasis on different parts of the leg development.

This is done by using an assortment of squat variations and foot placements; a narrow stance form squat will be more beneficial for quadriceps development than will a wide stance, Westside Barbell-style box squat.

Generally, full range of motion for complete development should be the focus when it comes to squatting. Not only do you rob your glutes and hamstrings of important work by cutting squats high, but also you put undue stress on your patella by artificially stopping at an unnatural point, counter to a full range of motion squat

where the muscles of the posterior chain aid you in stopping in the hole. In addition, who can argue with Branch Warren, Tom Platz, and Ronnie Coleman, three men with three of the best pairs of legs of all time, who religiously full squatted.

Bottom line: partial squats equal partial development.

Full squats provide greater glute activation. Therefore you should only use partial squats sparingly, if at all. Once you gain proficiency in partial squats, you might be able to handle hundreds of pounds over your true squat max, but this can cause back problems because of spinal compression with excess weight over your max and, of course, undue stress on your knees.

Your body was created to go through the full range of motion, and we are after full development for optimal performance in both everyday life and bodybuilding. Look at Asian and Aboriginal cultures that constantly full squat yet have a low rate of knee injuries.

Here are a few to tips to effectively squat heavy weights with full range of motion:

- Walk out with one step on each leg; make your walk out as short as possible to safely perform the squat.
- Initiate the movement by breaking at the hips, not the knees.
- Push the knees out as you descend, reverse, and ascend.
- Always keep the knees in line with the toes to avoid unnecessary stress on the knees and connective tissue.
- Hold your breath throughout the entire movement; breathe between reps.
- Come out of the hole by driving your head and upper back into the bar.
- Keep your chest up.
- Keep the back arched and shoulder blades together.

For more than a century, the squat has been hailed as the king for gaining size and strength. Various studies have demonstrated that weight training in general increases growth hormone and testosterone levels during and post exercise. It now appears this acute response is more important in hypertrophy and tissue remodeling than chronic changes in hormone levels at rest.

To maximize these benefits, use training programs that are moderate in intensity with short rest intervals and high volume; these will elicit the greatest acute hormonal elevations.

Compound movements increase testosterone and growth hormone, and squats do the most of any resistance exercise (including the leg press). The body's natural release of testosterone and growth hormone is a catalyst for muscle growth.

What does this mean?

If you have no preexisting injuries and want to maximize the release of anabolic hormones without using illegal performance-enhancing drugs, squat!

If you want your muscles to grow, squat!

A study by the University of North Dakota compared muscle recruitment during a leg press and a free weight barbell squat lift. The study used two groups of subjects. Group 1 was composed of 10 untrained, healthy men, and Group 2 was composed of 16 trained, healthy male athletes. The analysis method used was electromyographic (EMG) activity. EMG activity was recorded from the erector spinae (ES), gluteus maximus (GM), vastus lateralis (VL), and biceps femoris (BF) muscles. The leg press and the barbell squat were the exercises performed.

All subjects in Group 1 lifted three repetitions of both exercises using a weight equivalent to their respective bodyweights, which ranged from 155 to 165 pounds. In Group 2, each subject performed three repetitions of both exercises using a weight equivalent to 80% of his one-repetition max in both lifts, which ranged from 225 to 600 pounds.

The results indicated that in Group 2, the trained group, the squat exercise elicited significantly more EMG activity than did the leg press in the ES, GM and BF. A significant difference in the VL activity was not observed between the two exercises, but the activity in the VL was still slightly greater. In the untrained group, Group 1, the results were nearly a reflection of the trained group. The leg press utterly failed to recruit the ES, GM, or BF to the degree the barbell squat did, and the quadriceps were slightly more stimulated in the squat than in the leg press.

Every single lower body muscle was more active in a squat versus the leg press! So much for the legs getting more direct work in the leg press.

Bodybuilding Squat Variations

Front squats. Front squats are a tremendous exercise for building overall thigh mass and placing a special emphasis on the quadriceps. This exercise requires tremendous core strength because the load is placed on the anterior portion of your shoulders, directly compressing downward on your abdominal muscles. Flexibility of the arms, shoulders, and wrists is required if you hold the bar in a racked position like an Olympic lifter does.

For bodybuilders, a crossed-arm style is generally preferable.

We are after working the muscle, not direct transference to a push press or athletic movement. But more importantly, there is no reason to put undue strain on the shoulders, elbows, and wrists.

Some important advantages of the front squats are that they force technical proficiency, unlike a back squat. When back squatting, if you lose technique by bending too far forward at the waist or rounding over, you can good morning the weight up. If this same situation arises on the front squat, you will be forced to dump the weight, reinforcing technical requirements of the lift.

Another advantage of squats is they are more quad dominant, an advantage for paranoid bodybuilders afraid of having their butts grow too large. Many bodybuilders swear by this movement for development of the vastus medialis, the teardrop muscle of the quadriceps.

Front squats are easier on your back because your torso is more erect and, obviously, less weight is being handled. This upright position reduces some of the stress and sheer force on the lower back, making a great alternative for bodybuilders who have lower back issues and find back squatting painful. Furthermore, front squats are also a good tool to teach someone to back squat with an erect torso.

An effective squat variation can also be performed by the athlete's holding dumbbells, using a safety bar, or squatting on the Smith machine. The Smith machine allows you to directly work the muscle with no stabilization issues.

Remember, limit strength is primarily built with free weight compound movements. The Smith machine, when abused, can cause overuse patterns because of the total elimination of freedom of movement, as it has a fixed-pattern movement set by the machine and, of course, your stabilized muscles will be completely robbed of any work.

Does this mean you should never use a Smith machine?

No, it does not. The machine can be a great "finisher" movement or great as part of a multi-movement set, but it should not be the first choice for developing your limit strength base.

Remember, studies show Smith machines can place 40% more sheer force on your knees than free weight squat movements can.

Be careful not to do too many reps on the front squat; as strength coach Charles Poliquin advises, "Your rhomboids will tire out isometrically before your quads concentrically. You do not want to get to the point where you are squatting with kyphotic posture. This is when accidents happen."

In other words, don't make the exercise about a futile attempt to maintain proper posture. Instead, focus on building the thighs, as fatigue and maintaining proper posture can become issues when going beyond six to eight reps with heavy weight.

What does science say about front squats?

One 2008 study published in the Journal of Strength and Conditioning concluded that the front squat was as effective as the back squat in regard to overall muscle-mass recruitment during the lift. Moreover, the front squat produced significantly fewer compressive forces on the back and less sheer force on the knees.

The group determined that front squats may be advantageous for long-term joint health and for individuals suffering from back and knee problems. Remember, during this study, subjects used 70% of their bodyweight for front squats and 90% for back squats, so this played a role in measuring sheer and compressive forces.

Another study performed by the University of Texas, Arlington, with loads of 65 pounds comparing front and back squat, showed very similar muscular recruitment patterns for both lifts but significantly more quadriceps—in particular, the rectus femoris was recruited during the front squat.

Although it is safe to say that most bodybuilders do front squats with much more than 65 pounds, it is interesting to see peer-reviewed science concur with "bro science."

Other studies that measure EMG (electromyography, the electrical activity of muscles) show back squatting variations to be superior for quadriceps development. Some of the variation may be due to the individual lifter's technique and, of course, loads used. Generally, athletes can back squat more than they can front squat; how much more will vary, so it is difficult to test proportionate loads.

Additionally, EMG is not the only way to measure the effectiveness of an exercise from a hypertrophic and strength build. Standing-point stretch during the exercise must be examined along with continuous tension on the muscle throughout the exercise, mechanical work performed, speed of movement, and the weight being used.

This is a complex question, but EMG certainly provides a great angle from which to evaluate the effectiveness of an exercise. In-the-trenches experience and observations show that front squats are a fantastic quadriceps builder, and two of the strongest groups of humans on the planet, Olympic weightlifters and track and field throwers, have relied on this movement for decades to build limit strength.

Safety squats. The safety squat bar is an effective training tool that is gaining increasing popularity from top-level pro bodybuilders such as Branch Warren and Johnnie Jackson to regular

Joes who report less back pain and more thigh development. Properly used, the safety bar, often called the Hatfield bar because of Fred Hatfield's endorsement, is one of the most effective leg training modalities in the bodybuilder's arsenal!

Get ready, because your quadriceps are in for a real treat.

When you perform safety squats, your hands are not holding the bar. This allows you to grasp the handles on the power rack. Strong bodybuilders need to use massive poundages to yield the most from squats, and sometimes these enormous loads cause "rounding" of the back, which is all too common and places large amounts of unnecessary stress on intervertebral discs.

The safety bar squat circumvents this issue by letting the athlete exert pressure against the power rack by grasping the handles and thus maintaining a perfectly straight back throughout the entire squatting motion. Using your hands to spot yourself prevents you from falling forward or backward.

When you squat with a straight bar, you are forced to use a load that you can handle in the weakest position. This results in using an inadequate amount of weight in the strongest position of the squatting motion.

When the "sticking point" is reached, the hands can be used to help you get through it while maintaining optimal form. Furthermore, this will enable you to work with heavier weights in the ranges of movement in which you are strongest, and it gives you help when you are weakest. As such, you get the advantage of continuous tension on the muscle throughout the entire range of motion like a cable offers, but while you're performing a squat! The fact that you needn't use your hands to hold the bar on your shoulders eliminates wrist, shoulder, and elbow discomfort, and that's a great thing.

I first learned of this bar in high school when I was training at Santa Barbara Gym and Fitness Center, a place where Dr. Sal Arria, Dr. Fred Hatfield, and Ed Coan all had trained.

I watched some older powerlifters, who lacked the shoulder mobility to perform regular squats, substitute the movement with the safety bar. I remember reading years ago that Dr. Fred Hatfield had said a majority of his shoulder pain was from squatting, not from bench pressing!

The pad on the safety bar ads an element of comfort; heavy squatting is not about comfort, but it certainly doesn't take away from the experience.

Because you can use your hands to regulate body position, your posture under the bar can be adapted to suit your leverages so that you can literally "tailor" your squatting style to afford maximum overload.

Go to any powerlifting meet, and you'll see that the majority of big squatters with the heavy poundages have a distinct forward lean. This is because regular squatting places the weight behind you, approximately 4 inches behind your

body's midline. You are forced to lean or bend forward for balance—to what degree depends on the individual. When you use the safety squat bar, the weight is distributed directly in line with your body's midline, so there is no need to lean forward, thus reducing strain on your back.

The disadvantage of the safety bar is that it is tough to quantitatively track data, meaning it is literally impossible to know exactly how much your arms are helping pull you through a sticking point.

A 500-pound safety squat with 50 pounds of pull from the arms is different from one with 120 pounds of pull; keep this in mind when tracking overload and limit-strength gains. Safety bars can also be effective and comfortably used for front squats.

Other specialty bar squats/devices. Many other specialty bars are available that can help eliminate shoulder, elbow, and wrist stress while you squat and, of course, which hit the muscles at different angles. Many well-equipped gyms will have a huge array of bars to choose from.

Although variety is the spice of life, some continuity among core lifts is required to track progress or lack of progress. Some of the specialty bar/devices include (but are not limited to) the Buffalo Bar, Manta Ray, Yoke Bar, Front Squat Harness, Zercher Squat Harnesss, Thick Bar, and Cambered Bar. Most of these cambered bars are available at EliteFTS.com.

Dip belt squats. John McCallum popularized dip belt squats in the March and April 1970 issues of Strength & Health magazine. This exercise is great for building the thighs, but it primarily offers a great alternative to spinal loading.

Although various squat movements may have different levels of downward compressive forces,

the dip belt squat does not, because the load is placed under the athlete, not resting on the shoulders or even above the head.

This movement generally should be done for six to twenty reps. This is also a great movement for periods of lower-intensity "deloads" because of the lack of spinal compression. And because

the back of course cannot be used to assist the weight up in a good-morning fashion, less total weight is used but a great overload is still directly applied to the legs.

Performing the belt squat: Preferably place two boxes parallel to one another to accommodate your squat stance; if these are not available, two exercise benches can be placed to perform a v-shaped configuration for you to stand on; however, this is much less safe. Place a solid box between the two boxes you will be standing on. This is where you will place your loading pin with the weight you will use in performing the exercise.

Zercher squats. Zercher squats have showed the most glute work via EMG of any squatting variation, according to Arizona-based strength coach Bret Contreras.

The Zercher squat was brought to light by old-time strongman Ed Zercher. This movement

is performed simply by placing the bar in the crooks of your elbow. Rack the bar in the squat rack, obviously lower than usual because it is held in the crooks of your elbow.

This exercise is tough and requires a strong core. Because of bar placement, a great deal of spinal compression is eliminated. This exercise is unique because of the tremendous glute strength and core-strengthening qualities brought about without a large amount of spinal compressive force. You won't see a great many bodybuilders using this exercise, but it can be effectively used to build limit strength and cycled into your training.

Box squats. The box squat has been around for decades but was not really made popular until the 1990s via the insightful writings of strength coach Louis Simmons (who was heavily influenced by US Olympic Hammer Thrower, the late George Frenn, a world-record holder in the squat).

One benefit of box squats is that they require less recuperation time than regular squats do. People strive to keep their shins perpendicular to the floor when squatting. Yet box squats allow an athlete to go past this point because they put the

stress on the hips, glutes, lower back, and hamstrings. These muscles are called the posterior chain. This refers to the backside of an athlete's body. A weak posterior chain is much more common than a weak front side is, and box squats are one of the most effective modalities for developing a strong posterior chain.

Although the bodybuilder may not try to effectively load the posterior chain muscles to aid powerlifting or sport performance, certainly many bodybuilders have weakness in this area from an aesthetic standpoint or from a muscle-weakness standpoint that directly inhibits a movement like the deadlift, which indirectly limits back development.

Generally, we say full range of motion for full development when box squatting depth is not an issue because either your butt was on the box or it wasn't. This eliminates unnecessary guesswork.

Box squats are performed in a similar fashion to how regular squats are. Some chief points to remember:

- Fill your abdomen with air as you push your stomach out (or you could say "abdominals out").
- Push your knees out to the side and push your butt back (do not concentrate on sitting down but sitting back).
- Keep the back arched as you sit your butt completely on the box and pause, and then come up.
- When you are sitting on the box, every muscle is kept tight (excluding the hip flexors). When the athlete releases and then contracts the hip flexors along with arching the upper back, the athlete will explode off the box, building great starting strength.
- Additionally, box squats teach the athlete to explode up using the hips, hams, and glutes. This is critical for any sport that requires explosive movements. This may not be your core lower body movement when prepping for a show, but it certainly can help bring up weaknesses in the off-season or just periodically be cycled into your training plan.

Squats and Overall Development

Squats are the king when it comes to building muscle!

Remember, people with larger amounts of muscle mass have higher metabolic rates. The more muscle one has, the more calories one burns, even at rest.

Award-winning ISSA-certified personal trainer George Baselice added this on the subject of fat loss as it relates to squat:

The squat challenges your cardiovascular system to an extent unequaled by any other weight training exercise. The reason being the hypoxia effect, in which oxygen intake or use is temporarily inadequate. This breathless state is a tremendous metabolic stimulator. Squats will build an armor-clad heart and lungs, like a high-performance engine.

In addition, numerous studies show lifting weights with the hypoxia effect increases the secretion of anabolic hormones along with sparking a hypertrophic response from training.

Build a base—it's time to start squatting!

Squatting Myths Dispelled

"Squats will give you a broad butt." First off, my practical observation is that many folks squat without getting big butts. Wide, intermediate, or narrow—it doesn't really make that much difference.

When the hypertrophy of the gluteus maximus takes place, the glutes grow back, not out. The origin and insertion of the muscle is not at the hips. Again, think practically. Most men and women who are lean and squat massive poundages have butts that go back, not out! There is no anecdotal or peer-reviewed information that suggests squatting widens the hips. This is a favorite of pure "bro science" practitioners; unfortunately, it is just a self-serving prophecy that eliminates a difficult movement.

"Squats are bad for the knees." Think of the SAID principle (Specific Adaptations to Imposed Demands): calluses build up on the hands when you routinely pick up heavily knurled pig iron.

The same concept applies to ligaments, tendons, and other connective tissues that thicken in response to the stress imposed on the joints during weight training. Also, strengthening the muscles that move the knee joint improves its stability (a plethora of journal published peer-review studies confirm this), and there's some evidence that even the portion of the bone into which the tendons insert becomes stronger, further improving the joint's integrity.

This all goes out the window if you relax the muscles while in a rock-bottom position; that's just asking for trouble because the relaxed muscles allow the knee joint to separate slightly, placing the ligaments and cartilage under stress that may exceed their tensile strength.

Although proper stress produces adaptation, overly stressful exercise can cause breakdown of bodily tissue. This refers to full squats; they allow the muscles of the posterior chain to aid in naturally stopping the movement and reversing the muscular action.

I am confident in saying that someone with no preexisting conditions who does full squats with proper technique will have healthy, more stable knees.

"Smith Machine squat variations and leg presses are safer than free squats." Whether it's a Smith Machine squat or leg press, regardless of the design, the apparatus has a preset motor pattern that the manufacturer determined. This

motor pattern may not be ideal for your individual body type. It is built for the average person. Odds are that you are not "average," and there may be no real adjustment for body structure. Very few people would fall into what the manufacturer considers an average person.

Consequently, you may develop postural and movement dysfunctions. Furthermore, overuse injuries can occur because of the fixed, restricted joint movement pattern. Studies have shown Smith Machines place over 40% more sheer forces on the knees than proportionate loads in the free squat do.

The leg press has been shown to make athletes more prone to lower back problems because at the bottom position, the hips are very deep into flexion. The knees get close to the chest, and many times the back is raised off the pad. This is actually more common than you think, and instead of the leg press's saving your spine, it leaves the spine very susceptible to large compressive forces. Because the leg press is built to optimize leverage and there is no stabilization involved, much more weight is used than with a squat, making the compressive forces in this unnatural position with heavier weights potentially much more dangerous.

World-renowned personal trainer Brian Dobson, owner of Metroflex Gym, says, "My daughter can leg press 800 pounds, yet she struggles to squat 115."

How is this possible? The answer is simple. The leg press requires no balance, as the lower back and hips are not stabilized by the core of the body.

This brings us to the point that when a machine eliminates the stability factor, the legs are able to lift poundage much greater than when trunk stability is a factor. Hence, the forces transmitted on leg muscles and joints are much greater than the body could naturally transmit during the free squat. This potentially puts the hips, lower back, and knees at much greater chance of injury because of the artificially heavy loads you are forced to handle for maximum muscle stimulation.

"Squats are bad for the heart." Many weight-training exercises restrict blood flow because of prolonged muscular contraction. The result is elevated blood pressure. The condition isn't dangerous, and it's temporary.

The heart, as with every other muscle in the body, responds to stress by adapting to it. In time, the cardiovascular system is strengthened through weight training. This of course excludes those with preexisting heart conditions like extreme hypertension. For example, people suffering from coronary disease will find heavy squats more taxing than beneficial. If you are healthy, squatting can help you build a stronger, healthier heart.

"Squats are bad for the back." Dr. Robert Wolff, in his iconic book Bodybuilding 201, points out that research demonstrates that squats—often criticized because they're "bad" for your back—could actually be doing your spine some good. In many modern health clubs, the popularity of exercise machines has left the squat rack relegated to a dark, dusty corner in the back of the gym. However, this recent trial shows that squats (and other related exercises, such as the deadlift) could be the best way to maintain the strength of your spine as you get older.

A study published in the International Journal of Sports Medicine examined the back of the man holding the current world record for the squat. Despite the man's being able to squat more than 1,000 pounds, several scans revealed a remarkably healthy spine.

- MRI scans revealed normal spinal alignment. There was no evidence of disc herniation.
- In addition, there was no sign of compressive disc disease. More important, the scans also showed an extremely high level of "bone strength" (called bone mineral density) in the spine.

This is important, especially for women. According to some estimates, one out of every three women over the age of 65 will suffer a fracture of the spine. A reduced bone mineral density—which increases your risk of a fracture—is far more widespread than previously thought. Recent surveys show that almost 40% of women age 50 or over have osteopenia, which is a mild bone mineral loss.

When calcium in your diet runs short, the body drains the calcium stored in your bones. This weakens them significantly. Some bones, especially those in the spine, can become so weak that just the weight of your body causes them to suddenly disintegrate, often into scattered fragments that cannot be reassembled. Your spine can also become "compressed" during old age, forming what is often called "dowager's hump." This is the posture assumed by many older women as they appear to get shorter.

One last tip: When squatting with a heavy weight, make sure to avoid the popular recommendation to keep your back flat. According to Dr. Mel Siff, in his book Facts and Fallacies of Fitness, a flat back is "virtually impossible" for the average person to achieve:

Keeping the back "flat" is common advice given in the gymnasium training environment, yet its validity is rarely questioned. Actually, not only is a flat back devoid of any curvature virtually impossible for the average person to achieve, but also it reduces the ability of the spine to absorb or distribute shock and stress effectively.

Although numerous factors affect the strength of your bones, training with heavy weights is one of the best ways to ensure you're still leading an active life right into old age.

Final Thoughts on Squatting

I think this poem by Dale Clark sums it up well:

Way down this road in a gym far away
A young man was once heard to say
"I've repped high, and I've repped low
No matter what I do my legs won't grow."

He tried leg extensions, leg curls, leg presses too
Trying to cheat these sissy workouts he'd do.
From the corner of the gym where the big men train
Through a cloud of chalk and the midst of pain

Where the big iron rides high and threatens lives
Where the noise is made with big forty-fives
A deep voice bellowed as he wrapped his knees
A very big man with legs like trees

Laughing as he snatched another plate from the stack
Chalking his hands and his monstrous back
Said "Boy stop lying and don't say you've forgotten.
Trouble with you is you ain't been squattin."

THE OVERHEAD PRESS

"Only military presses provide the compound distribution of stresses necessary for overall shoulder width and thickness," Ronnie Coleman said in the May 2004 edition of *Flex* magazine.

The sport of Olympic weightlifting consists of a combined total of the clean and jerk and snatch. Up until 1972, Olympic weightlifting included a third lift: the overhead press, or the "press," as it was referred to at that time. The overhead press

was extremely popular, but it has since lost favor in many strength -training programs.

This is too bad because the overhead press is one of the most effective exercises to build strong and powerful shoulders and to add overall size to the upper body.

The overhead press is performed by an athlete's resting the bar on the shoulders in the front; legs are locked, and the back is straight. From the resting, or rack, position, the bar is lifted until the elbows are fully extended over the head, with the head all the way through.

A common mistake is not to fully lock the weight out and to push the weight in front you; by doing this, you completely rob the posterior portion of your shoulder, not to mention the peak contraction at the top of the movement.

Although the overhead press is primarily a shoulder movement, this move forces the entire body to work in concert. The athlete's legs and core stabilize the weight, and the shoulders and triceps press the weight up.

A good coaching cue is to tell the athlete to "squeeze your glutes." This will force the athlete to stay upright and not excessively lean back; this is the reason the movement has been dropped from competition; it is difficult to judge what is a legitimate overhead press and at what point it becomes a standing bench press. As bodybuilders, we try to safely maximize the growth of the shoulders; why it is important to stay upright is obvious.

For the most part, the overhead press works the entire shoulder, unlike the bench press, which works mostly the anterior deltoid. Specifically, overhead pressing allows free movement of the scapula, whereas in the bench press, the scapula is retracted. Because of how the shoulder is worked in this lift, the overhead press can eliminate muscle imbalance issues and enhance overall shoulder health. When selecting exercises, it is important we think not only of potential muscle gains but also of overall balance and health of the body.

The overhead press does have some variations. Three of the more popular ones are seated overhead press with a barbell (a staple in the regimens of both Ronnie Coleman and Branch Warren), the seated overhead press with a dumbbell, and the standing dumbbell press, which is performed like the standing press is except that dumbbells are used.

Some old-time bodybuilders even used the push press, which in turn helped them develop total body strength and rate of force development. Although those two motor abilities may not be the most important in contest prep, they could pay huge dividends in building a solid off-season base.

Remember, many elite bodybuilders will be unable to perform this movement properly because of their large arm development, so by forcing this position, undue stress might be placed on the shoulders, elbows, and wrists in the rack position. Though this may not be the end of the world in a standing press, it is ill advised in the push press because of the movement's ballistic nature.

The push press is performed in the same manner as the standing press is but with leg drive. As

with the squat, the push press needs to be initiated with hip movement first by sitting back and then dipping down like a vertical jump and using the hips, quads, and shoulders to push the bar to extension above the head.

Dumbbell military presses, seated or standing, offer some advantages. Dumbbells allow for each limb to move independently and are harder to stabilize than barbells are.

Dumbbells allow the joints to follow their natural/desired movement pattern. The dumbbell military press can be performed seated or standing. When you perform the dumbbell press unilaterally with one arm held in extension and the other dynamically pressing the weight, time under tension can be greatly increased without sacrificing much intensity.

Another unilateral variation is standing and pressing the weight unilaterally with one arm

while bracing on a squat rack with the other; this will hit the muscle at a different angle and allow a greater range of motion to be achieved. This is also an effective way to overload the deltoids with "cheat" reps because of the relative simplicity of the movement compared with that of the bilateral push press. Plenty of variations of this old-time favorite can be used to build massive bowling-ball delts and increase physical prowess.

The majority of the most muscular and strongest men of all time have included the overhead press in their arsenal. If you do not have limiting preexisting conditions, it would be wise to follow suit.

CHIN-UPS

Former World's Strongest Man winner and world-record holder in powerlifting, Bill Kazmaier, once said, "A strong back equals a strong man." I will take that a step further and say a well-developed back equals a well-developed man.

Brian Dobson, ISSA master trainer, bodybuilding guru, owner and founder of Metroflex Gym, and the man who introduced Ronnie Coleman to bodybuilding, has espoused on numerous occasions, "Chin-ups and deadlifts are the king when it comes to building the back."

Let's look at the first half of that equation and examine why this amazing exercise is being classified as a core lift.

Chin-ups will require you to lift your own bodyweight and, as you advance, additional weight should be used. This is generally a very effective exercise for adding muscle mass and gaining functional strength. Though functional strength is not our goal as bodybuilders, it is a certainly a positive byproduct of this exercise.

Chin-ups are quite difficult for many people, especially heavier people. Many folks new to strength training will not be able to perform even a single chin-up. With dependency on anabolic drugs and shortcut training methods, unfortunately, many heavier bodybuilders will struggle to squeeze out even a few chin-ups.

I keep saying "chin-up," and many may wonder whether there is a difference between a chin-up and a pull-up. The answer is, yes, there is. Pull-ups are harder than chin-ups. Pull-ups require your grip to be pronated (meaning you have an overhand grip with palms facing away from you). Both can play a vital role in your pursuit of physique and power.

When performing chin-ups, your grip is supinated (meaning it is underhand and your palms are facing you). Pull-ups focus more on the back muscles alone, whereas chin-ups hit the back and the biceps as well.

A large number of bodybuilders and gym rats alike whose biceps have reached behemoth proportions favor cheat curls over strict isolations and machines for biceps growth. This may be contrary to what you read in the health fitness section of your local newspaper.

Look no farther than Arnold Schwarzenegger, the pioneer who broke the mold and

Figure 3.1 Chin-up. Chin-ups require a supinated (underhand, palms facing you)

Figure 3.2 Pull-up. Pull-ups require a pronated grip (overhand grip, palms facing away from you)

implemented cheat curls in his training. Most of his peers felt he was crazy! Since then, whether it be Bill Kazmaier or Ronnie Coleman, cheat curls have played a role in helping to develop the biggest, strongest arms of all time.

This is not taking a bizarre twist, though, as chin-ups and cheat curls have some similarities that are a catalyst for biceps growth.

While you perform a chin-up, the back will assist you, and the biceps are in flexion at the end of the movement. This provides a huge biceps overload at the top portion of the movement, just as a heavy cheat curl does.

Arnold was mocked because of his implementation of the cheat curl; however, one generation's heretic is another generation's hero. This discovery has helped many build huge biceps and is even considered an illustrious Weider Principle—which will be discussed in a later unit.

Is the cheat curl effective? *Absolutely.*

Is it dangerous? Well, *it certainly can be.*

Unlike the cheat curl, the chin-up is one of the safest ways to build your biceps. Think about it logically. Compound movements build big muscles, increase inter-muscular coordination and intra-muscular coordination, and release the anabolic hormones, thus chin-ups will make your biceps grow.

Closed-kinetic-chain movement: Exercises performed in which the hand (for arm movement) or foot (for leg movement) is fixed in space and cannot move.

Open-kinetic-chain movements: Exercises that are performed in which the hand or foot is free to move.

Closed-kinetic-chain exercises are superior to **open-kinetic-chain exercises** for a few reasons.

A closed-kinetic-chain movement essentially means that during the exercise you move through gravity; an open-kinetic-chain exercise means the object you are lifting moves.

Think about a bench press and a push-up: During the push-up, you move; during the bench press, the bar moves.

Let's apply this to the cheat curl and the chin-up: During the cheat curl the bar moves; during the chin-up, you move.

Closed-kinetic-chain movements are much safer on your body because they allow the individual's body structure to determine the movement pattern of the joints and the range of motion they operate. This in turn removes excessive stress off the joints and places it on the muscles, which should be doing the work, and then they have no choice but to grow.

On the Internet, some functional training extremists like to pontificate that to maximize biceps development, all one needs to do is chin-ups. I believe this is false, but they certainly can aid in the quest for massive, muscular arms.

These are the two basic variations, but there are plenty of others.

Neutral-grip pull-ups are performed with a medium grip, but variations can be with hands wider or narrower. The shoulder is able to stabilize your body most effectively with a neutral grip. This grip puts the elbows and shoulders in their most effective line of pull. This is the easiest pull-up variation, so additional loads can be used more quickly. The biceps are used much more with this grip than with traditional pull-ups.

Not only do chin-ups increase your limit strength, they also lead to improvements in grip strength. Your fingers, your hands, and your forearms are all used when you perform chin-ups. Because you have to stabilize your core in a chin-up, even the abdominals get a workout.

If you cannot do chin-ups, the most effective way to train them is through band-assisted pull-ups. Simply attach the jump stretch bands to the chin-up bar. Then, attach the band to your weight belt. Start from a dead hang and pull up. As you pull up, the bands will start to assist you.

Negatives can help an athlete become more efficient at handling his or her body weight. These are done by having the athlete perform only the negative (eccentric portion) of the pull. These are also a great way to extend sets past failure: When you can no longer perform the positive portion of the rep, you can jump above the bar and slowly lower yourself through the negative portion of the rep.

To do this, the athlete jumps up and then lowers his or her bodyweight with no assistance for a specified amount of time. Partner-assisted pull-ups are another helpful modality in enabling an athlete to develop the strength to do a pull-up. These are done like a normal pull-up but with partner assistance.

As an athlete advances, he or she can do the negative without assistance. The only drawback to partner-assisted pull-ups is the lack of quantitative data on the concentric (upward) phase of the movement. It is impossible to know with accuracy how much a partner is helping. This can be troublesome in planning/tracking workouts.

Lat pull-downs are not as effective a means to develop the strength to do chin-ups. Chin-ups require you to stabilize your body weight. Lat pull-downs are done on a machine. As we are focusing on limit strength, we know that free movements, particularly closed-kinetic-chain ones, are superior to machines.

Lat pull-downs are an open kinetic chain movement, whereas chin-ups are a closed-kinetic-chain movement; the latter are generally superior for muscle building, strength, and functionality.

Additionally, when you perform lat pull-downs, the concentric portion of the lift is downward from the arms extended to the chest; this is the opposite of a deadlift, bench press, military press, or squat. As bodybuilders, we want to be strong in the aforementioned core movements; chin-ups offer superior transference to them.

Some points to ponder when doing a chin-up:

- Always use a full range of motion.
- Look up on the way up.
- Bend your legs and cross your feet, effectively squeezing your glutes.
- Keep your chest up.
- Drive up with your elbows facing the floor.

THE BENCH PRESS

I have a soft spot in my heart for the bench press. I was the youngest person to bench press 600 pounds raw and currently train the two top

bench pressers in the world, Jeremy Hoornstra and Al Davis.

Here are some tips that have helped my clients and me develop big bench presses:

1. **Practice compensatory acceleration training (CAT).** CAT is lifting your submaximal weight with maximal force. It will be discussed in greater detail in a later unit. By building explosive power in the bench press, you blast through sticking points. Lifting the weight with the intention of being explosive will make the weight feel lighter. Need proof? Walk over to the dumbbell rack, pick up a 50-pound dumbbell quickly, and then lift it slowly. The weight will feel lighter when picked up quickly. You can't intentionally lift a maximal weight slowly.
2. **Implement dead benches into your routine.** A dead bench is done in a power rack. The weight starts at chest level and is pressed up as explosively as possible. You will not be able to lift as much weight this way because of the absence of elastic-like energy stored on the negative portion of the lift. Because this lift is concentric (upward phase) only, you build tremendous starting strength. Bench pressing big weight begins with great starting strength off the chest. Build it with dead benches!
3. **Do more sets with fewer reps when training for a one-rep max.** Let's look at two scenarios: In Workout A, you do eight sets of three reps; in Workout B, you do three sets of eight reps. In both workouts, you will have completed 24 repetitions. However, in Workout A, you had 8 first reps, whereas, in Workout B, you had only 3 first reps. Because you are training for a one-rep max, first reps are important.
4. **Work your arms.** Very few people with spaghetti arms bench huge weights. Obviously, the triceps are crucial to lock the weight out and can be built through close-grip bench, board presses, various extensions, and an array of other exercises. However, the biceps help stabilize heavy weights, and strong forearms help you squeeze the bar tight. This will make the weight feel lighter in your hand.
5. **Visualize your success.** Your central nervous system cannot tell the difference between a real and an imagined experience. Set some time aside every day to visualize yourself blasting maximal weights. Go to the gym, load your goal weight on the bar, and stare at it; see yourself lifting it. The more vivid the experience, the more real it is. When you eventually attempt the weight, you will only be going through the motions because you have done it repeatedly in your head.

Former powerlifting world champion and renowned trainer Rickey Dale Crain once said, "The bench press is the best basic upper body lift, and that is, it works more muscle groups than any other upper body lifts."

Some have hailed the bench press as the holy grail of lifting and other chest movements have been mocked as a complete waste of time. Arnold Schwarzenegger, Doug Young, Ronnie Coleman, and Bill Kazmaier all had the bench press at the core of their chest routine.

In recent times, there has been sort of an anti-bench-press renaissance among strength and

conditioning professionals. Admittedly, there are not large, long-term studies on the bench presses' effectiveness in contrast to that of other exercises. This is because it would be extremely difficult to persuade a large cohort of untrained college students to undergo a serious long-term strength-training program. And it would be a fantasy to try to convince a large group of advanced bodybuilders to alter their regimens in the name of science.

The most intelligent course of action is then to look to the trenches. From Arnold Schwarzenegger to Ronnie Coleman, the most-developed chests have had the bench press at the nucleus of their programs. Furthermore, powerlifters bench press as part of their sport, and though they may not be stage ready, the cream of the crop has great pectoral development.

From elite bodybuilding circles to mainstream strength and conditioning, the bench press has stood the test of time. Until science dictates a more effective alternative, I will advocate the bench press

To reinforce the point, the bench press allows for the heaviest weight of any exercises to be handled, and it is a true strength builder. The bench press is a compound, multi-joint exercise that can benefit most bodybuilders.

Some things to remember when bench pressing:

- Your grip width for a regular bench press grip should be slightly wider than shoulder width.
- You can bench with your thumb wrapped or not wrapped around the bar. If you choose not to wrap your thumb around the bar, use excellent form to make sure the bar doesn't move away from your grip during the movement.
- The bar should be close to your wrist and palms, in your hands, not by the fingers. (This would be a recipe for severe wrist pain.)
- When gripping the bar, you should make sure to squeeze the bar.
- Tighten your upper back before you lift the weight out of the rack. This gives you a solid base from which to perform the press. If you do not keep your chest up, you increase your chance of incurring shoulder injury and lose power. You also lose the benefit of the peak contraction at the top of the movement.
- You must maintain this chest position through the entirety of the lift.
- Use a full range of motion for the majority of your training. The pectorals are the prime movers for the bottom portion of the movement, and by missing the peak contraction at the lockout of the movement, you rob yourself of full chest development.

Bench Press Variations for the Bodybuilder

Two of the more popular variations of the bench press are these:

The incline bench press. This movement is used by bodybuilders to maximize the development of

the upper (clavicular) portion of the chest. This is not just "bro science," as EMG studies have actually shown that the upper pectorals have higher electrical activity on the incline bench press than on a barbell bench press.

Generally, the most effective angle is 15 degrees all the way up to 40–45 degrees; below this, the emphasis will shift more toward the lower portion of the chest, and above this, the work will move more to the anterior deltoids. Dumbbells can be used for this movement as well. This is an extremely effective movement for building limit strength and, of course, developing a massive chest.

The decline bench press. Declines are a favorite for overloading the lower (sternal) portion of the chest. As with the incline or the flat bench, dumbbells can be used. Declines seem to be most effective at an angle of 20–25 degrees. Going below this angle will bring the lats too much into play, and above this, the movement will start to engage the clavicular portion of the chest more than desired. Many bodybuilders will be able to lift more weight on this movement than even with a flat bench press, providing an amazing overload.

Remember that the pectoral muscles perform two primary functions: flexion and adduction of your upper arm. Both of these happen during the upward phase of a decline bench. This is why six-time Mr. Olympia, Dorian Yates, feels the decline bench press is superior bodybuilding for chest development.

Final Thoughts on the Bench Press

Plenty of other bench press variations are quite effective. Look at some of the ones that powerlifters, our brothers in iron, use: neutral grip bench press, close grip bench presses, wide grip bench press, floor presses, and board presses. These are just the tip of the iceberg.

THE DEADLIFT

It is safe to assume that the deadlift is the oldest strength -training maneuver in existence. There's no real documentation to back this up, but it makes perfect sense when you think about it. Bench presses and squats took ingenuity on the

part of our iron-game predecessors. But there is nothing more primordial than picking up an object and putting it down. Deadlift training, technique, and programming have been refined, but the main objective remains the same: You pick up heavy pig iron, you put it down, and you grow.

Ronnie Coleman has the largest back of all time, big enough for eight Mr. Olympia titles. It is important to pay attention to how he built it. Brian Dobson, MFS, and Coleman's longtime trainer, attributes Big Ron's massive back to one factor that's remained constant in his training programs through the years: "Deadlifts are the king" says Dobson,

Deadlifting forces you to use virtually every muscle in your body to take the bar from the floor to waist height. In the chain of muscles involved in this process, nothing is left behind, and everything kicks in eventually.

"Everything" starts with your lower back.

Nothing builds your spinal erectors like the repetitive action of bearing and moving a massive load does. The deadlift isn't just a lower-back exercise though. As you move through your range of motion and transition from the lower part of the lift to the upper lockout phase, your lats, traps, and other upper back muscles take over.

At the top of the movement, you're holding a very heavy weight in a dead-hang position—which places immense pressure on your traps. This is a highly efficient combination of movements for building thickness in your upper back and shoulders.

In the bottom position, proper deadlift technique entails pushing through your heels to move the bar out of a static position. By focusing on this leg drive, you're applying a tremendous amount of force to your quads, hamstrings, and calves. Dropping your butt and pushing through your

heels with every rep will add mass throughout your lower body.

At the top of the deadlift, when you lock out your hips, your glutes act as the movement's agonist—its prime mover—while your hamstrings are targeted as the synergists, or assisters. When it comes to developing your glutes and hamstrings through the application of force, there's no better exercise than the deadlift. While this is not our primary focus as a bodybuilder, it's a great byproduct.

The benefits are not limited to your lower body.

Your arms come into play throughout your range of motion. When you're trying to hang onto a heavy load and move it upward, all the muscles in your arms are forced to contract, and enormous amounts of grip strength are required to hold onto a heavy deadlift without straps; this is a catalyst for forearm hypertrophy.

If grip is the limiting factor on the deadlift, wear straps. After all, we are using deadlifts to add mass and build the back, not for grip strength and forearm development.

Furthermore, straps will allow you to perform deadlifts without a mixed grip (meaning one hand is pronated and one supinated); a pronated grip can be used.

The advantage to this is a more efficient lockout because the hips are in a more efficient biomechanical position to lock the weight out. It also eliminates the possibility of asymmetrical development. The concentration can be on the muscles being worked and on exercise technique. Furthermore, and most importantly, the chance of a biceps tear is drastically reduced. Biceps tears are one of the most common serious injuries resulting from the deadlift.

Some reminders for proper deadlift technique:

- Push through your heels.
- The middle of the foot should be directly under the bar; the shins must be touching the bar.
- The back is in extension; don't round.
- The shoulder blades should be directly over the bar.
- The elbows must remain in full extension throughout the entirety of the movement.
- Lower the bar in the opposite way the bar was lifted, in terms of hip and knee angles.

Partial Deadlifts

Partial deadlifts can be performed in a power rack or off boxes. If you have access to boxes, this is a more effective variation because the flex of the bar is more similar to that of a traditional

deadlift, as the plates rest on boxes as they would on the floor. This provides a similar feeling of bar flex at the commencement of the movement.

In a rack, the bar rests on the pins, so the feeling is much different at the start. Additionally, you can lift more weight in a partial deadlift off a box. Generally, perform partial deadlifts at knee level and as much as 2–3 inches below and as high as 2–3 inches above.

Sometimes a partial deadlift will hit a sticking point, so even though you are lifting the weight less distance, you will not be able to handle as much weight as a full range of motion deadlift.

This is important, even for you as a bodybuilder, because a glaring weakness will stall overall progress. If you are going for the overload effect, obviously you will need to do the partial deadlift from a point where you have strong leverage.

Wear straps for this movement; grip training is not our primary purpose. Perform the lift by taking a hip to shoulder width stance. Bend your knees slightly, keep your back flat, and make sure your lower back is tightly arched. With arms in full extension throughout the entire movement, extend your hips and stand upright. Accentuate the lockout and hold this position for one to two seconds at the top to maximize muscular development.

Partial deadlifts allow us to attack weaknesses and provide a huge overload; hoisting massive weights equals massive development. This movement, in my opinion, is one of the most underrated for upper back development and helpful in building your limit-strength base. Note that the partial deadlift should not be incorporated into a training program year-round but rather should only be used during targeted training cycles to overcome specific weaknesses in the deadlift .

Sumo Deadlifts

Sumo deadlifts are more of a leverage lift than a true strength lift or muscle builder. Just because the movement requires a much shorter range of motion does not mean you will be able lift more weight. A vast majority of powerlifting world records have been set using a conventional stance.

As bodybuilders, we deadlift to gain muscle and build our limit-strength base. Sumo deadlifting is far down on the list of modalities to accomplish either. For bodybuilding, stick with the conventional deadlift.

Final Thoughts on the Deadlift

The deadlift is the ultimate back builder, but deadlifts also work virtually every muscle in your body. Because of the number of motor units recruited, deadlifting (like squatting) is a catalyst for muscle growth.

Like the squat, the deadlift produces a very favorable spike in the natural production of growth hormone and testosterone production. If your goal is to lose fat, your post-oxygen debt will be larger because of all the muscle mass recruited (meaning your metabolic rate is greatly increased). Therefore, whether you are cutting or bulking, the deadlift can be a great aid in your arsenal.

BAR DIPS

Bar dips are called by many the upper body squat. The reason is the massive amount of muscle they can pack on the upper body. Once an athlete is able to master his or her bodyweight on this exercise, it is not time to ditch because the intensity is too low—it's time to add weight. This can be done simply with a weighted dip belt that can cost as little as $20.

Weighted dips were a staple muscle-building and strength-training movement before modern machines and gimmicks. Many top-level physique athletes swear by this movement for building the sternal (lower) portion of the pecs.

Here are some good reasons to include weighted dips in your training program:

- When performing dips with a more upright posture, the stress is more on the triceps.
- Dips with a forward lean and the chin tucked toward the chest while getting a good, deep stretch make this arguably the best chest builder on the planet.
- Weighted dips force you to handle your bodyweight plus an additional load. This means it is a closed kinetic chain movement, which is generally safer and more effective.
- Weighted dips force you to use your upper body and core to stabilize the load; unlike push-ups, your feet are not on the ground.
- Do a Google search on weighted dips for muscle hypertrophy. Many of the results will refer to this exercise as the "king" for the chest and the triceps. How many exercises can claim this kind of monopoly on two separate muscle groups?
- Dips build strength in functional activities and in strength tests. Pat Casey, the first man to bench press 600 pounds, had weighted dips at the core of his program. Want to bench big? Try dips! Moreover, they help the overhead press. Dips helped me win the overhead press with ease at the Atlantis Strongest Man in America Contest.
- Athletes with shoulder or elbow injuries may find dips to be a good substitute for bench pressing.
- Dips have been the staple of many great physique athletes. I have personally witnessed Branch Warren and Ronnie Coleman do dips on many occasions.

HORMONAL RESPONSE TO HEAVY CORE LIFTS

The more muscle fibers that are used during an exercise, the greater the hormonal and remodeling response will be. Only the muscle fibers used during the resistance training are subject to adaptation.

To increase the concentration of serum testosterone, remember these principles:

- Use heavy weights (greater than 85% of one-rep max).
- Use moderate to high volume, meaning multiple exercises or multiple sets and short rest intervals.
- Increase growth hormone levels by

performing higher repetitions (in the 10-rep range) and using short rest periods between sets.

- Optimization of the response of adrenal hormones to resistance training is achieved by using high-volume large muscle groups and very brief rest periods.
- Optimizing your hormonal response to exercise will keep you anabolic and increase your strength, and that's the goal of the powerbuilder.

A FEW LAST WORDS

Heavy core lifts may prevent injuries because they stimulate new bone growth. Thus, you should follow these guidelines when trying to stimulate bone growth:

- 3–6 sets with fewer than 10 repetitions.
- Rest period 1–4 minutes using a typical periodization scheme designed to increase muscle hypertrophy and strength.
- The exercises should be compound movements. (All of the previous exercises discussed would fall into this category.)

The body will adapt differently to various weight-training programs. If the goal is to increase muscle size (hypertrophy), a moderate load is called for (65%–85% of your one-repetition max), rest periods should be short (approximately 60–90 seconds), and repetitions should be in the 6–15 range. The optimal number of reps for muscle hypertrophy will vary with the individual.

Other factors (besides genetics, nutrition, and supplementation) that influence hypertrophic response to resistance training are time under tension, amount of weights used, range of motion, and, of course, exercise selection.

If your goal is strength, you will need to use more than 85% of your one-rep max, repetitions will be 5 or fewer, and a full recovery of 2–5 minutes will be taken.

If you are a bodybuilder, your goal is to build strength, size, and symmetry. Remember that exercise selection, rest intervals, and rep ranges will cover a wide spectrum.

Building size and strength takes time, so be patient. The gains will come. It is done best with core lifts as the foundation of your training program.

If we had to choose between core lift training and single-joint isolation lift training, the choice would be simple. The core lifts are the way to go.

Look at all of the great bodybuilders who started as powerlifters: Ronnie Coleman, Arnold Schwarzenegger, Franco Columbo, Branch

Warren, Johnnie Jackson, Ben White—and the list goes on. All of them have or had dense, grainy, shredded muscle. This was accomplished because of their limit-strength base.

Even if you decide to become chemically enhanced, it is important to build a great drug-free base. The reasons are simple: You will be able to maintain your gains much better after you cease the use of anabolics, and these lifts develop tendons and ligament, something steroids cannot do.

Heredity may have dealt you the cards, but training plays the hand.

You cannot shoot a cannon out of canoe…you need a base, so build it!

TOPICS COVERED IN THIS UNIT

Exercise Selection

Top Ten Exercises for Legs

Top Ten Exercises for Chest

Top Ten Exercises for Arms

Top Ten Exercises for the Back

Top Ten Exercises for Shoulders

Exercises for Abs, Calves, and Neck

A Few Last Words

UNIT 4

TOP TEN EXERCISES

EXERCISE SELECTION

Compound movements, isolation movements, bands, chains, barbells, dumbbells, machines … the choices are more numerous than the whisky selection is at an Irish pub. But which do you choose?

Why not choose them all instead of limiting yourself to only one? Remember, mechanical tension, metabolic stress, and muscle damage are all contributing factors to muscle hypertrophy. With science as your guide, you can never go wrong.

Mechanical Tension: Equates to muscular force in a strength-training exercises.

MECHANICAL TENSION

In spite of not following typical hypertrophy guidelines, powerlifters possess extreme muscular development. At a first glance, this would seem anomalous, but it confirms science because of the mechanical stress placed on muscles during a heavy powerlifting regimen.

Powerlifters avoid workout fluff because their sole objective is to pile more pig iron on the bar.

This has to be done with proper technique, or the weight lifted will not count in a contest, where it matters for the powerlifter. Heavy weight through a full range of motion with proper technique epitomizes mechanical stress.

Aha! It now makes sense why powerlifters pack on so much muscle. Even though muscles cannot quantitatively gauge the pig iron they lift in poundage, they know tension. A greater degree of muscle tension occurs as the weight of the bar increases, assuming proper technique is being used with a full range of motion. Increasing training weights is indispensable but never at the expense of form.

Metabolic Stress: Acid buildup in the muscle.

METABOLIC STRESS

Metabolic stress caused by moderate repetition ranges has generally been shown to be superior in achieving muscle hypertrophy. This range is generally in the 65%–85% of a one-repetition max, with repetitions ranging from six to fifteen.

Because metabolic stress is the objective for core lifts, rest intervals between sets are in the one- to two-minute range generally, for single-joint movements in the 45- to 90-second range. Rest intervals for pure strength training range in length from two to five minutes.

Some advocate that time under tension, not the repetition range, is the primary variable determining the hypertrophic response to weight

training. The logic is that 12 repetitions performed in a squat, taking 10 seconds each, with 40% of your one-repetition max, will invoke a much different adaptation than will 12 reps with 70% of your one-repetition max.

As weight increases, bar speed will decrease, so the muscles will be under tension much longer. Time-under-tension advocates generally believe 30–60 seconds is the ideal time to set completion for the best hypertrophic response.

Fueled by the immediate energy system, the anaerobic glycolysis energy system fuels the intensely performed moderate repetition ranges, or the time under tension in the 30–60 second range, causing a significant buildup of metabolites.

Studies performed on bodybuilders post workout, after performing exercises with moderate-rep ranges, show significant decreases in muscle glycogen, ATP, and creatine phosphate. To counter that, blood lactate, intramuscular lactate, and glucose increase and build up, serving as a catalyst for muscle growth.

Intense training in a moderate-repetition range will cause a full-spectrum muscle hypertrophy across slow and fast twitch fibers, aiding in maximizing development.

Training in this moderate repetition range provides for a great "pump," and this begs the question: Is the pump the end all, or is it just self-indulgence of overzealous, solipsistic muscle heads?

One camp is telling us that the pump is all that matters; another counters by exclaiming it's meaningless. Then who is right: the "bro science" muscle head or the crypto scientific functional trainer?

The pump is caused by a buildup of metabolic byproducts that cause the cell to swell; cell swelling has been shown to help increase muscle growth. The pump should not be worshiped as the end-all of muscle hypertrophy, but it can't be dismissed as feel-good bro science either.

SELECTING THE RIGHT EXERCISES

Compound exercises that involve multiple joints and multiple muscles have a much greater bang for their buck than do single-joint isolation exercises. Leg curls target the hamstrings; deadlifts also provide a great stimulus to the hamstrings in addition to virtually every other muscle in the body.

Taking a closer look at the reckoning of hypertrophy, the compound-exercise dynasty reigns superior to isolation counterparts. This holds true gauging exercise value through anabolic hormonal response, calories burned during training and post workout, cardiorespiratory demands, real-world functionality, injury prevention, range of motion, neural adaptations, or even poundage lifted.

Furthermore, as already discussed in the text, compound movements are superior for building limit strength, "your base." Odds are that athletes who have squats at the center of their leg development program will have more impressive leg development than will athletes who allocate a majority of their energy to leg extensions.

Compound movements, in general, are safer than isolation movements are because forces are spread across multiple joints and muscles. Core lifts, in general, need to remain at the core of the program. Isolation exercises are needed for supernatural development in certain areas and to bring up weaknesses through the overload principle of isolation.

Mechanical Work Performed

"The Veteran," though I never knew his real name, was an older gentleman, a retired

bodybuilder who trained at the same gym I did when I was growing up.

The first time I attempted to squat 405 pounds, I missed it. "The Veteran" saw this and then proceeded to scream at me and went on to threaten me with serious bodily harm if I did not come back and squat the weight in five minutes. Needless to say, his "encouragement" helped, and I made the weight.

"The Veteran" was crazier than an outhouse rat, but he had an amazing physique for any age. And he was in his 60s! "The Veteran" had absolutely no filter. There's nothing he wouldn't say. Anytime that someone came into the gym and did an exercise that lacked the proper range of motion, The Veteran would bark out, "Full range of motion for full development." Although The Veteran was not educated in formal exercise science, he was certainly wise.

A lack of range of motion will result in a lack of muscle being built because of the lack of tension throughout the entire range of motion.

An abundance of studies demonstrate that full range of motion exercises eclipse partial movements for inducing hypertrophy, not to mention that the more natural movement pattern of a full range of motion movement and the stretch imposed by using the full movement can even cause a subsequent increase in flexibility.

Performing partials requires you to use a much greater load than a full-range-of-motion exercise does; less muscle is being worked, but the stress on the central nervous system is exacerbated because of the supramaximal weights being lifted.

More mechanical work will lead to greater metabolic stresses, increased muscle tension, and more muscle damage. Mechanical work is simply the weight lifted, multiplied by the distance it is lifted, multiplied by the number of repetitions.

Hypothetically, you can squat 400 pounds for 5 repetitions, and your full squat range of motion is 24 inches. What if you can quarter-squat 600 pounds for five repetitions?

Simple arithmetic can determine the amount of work being performed. Full squats would be 400 pounds × 6 repetitions × 24 inches = 57,600 pounds of mechanical work. Quarter squats would be 600 pounds × 6 repetitions × 6 inches = 21,600 pounds of mechanical work.

Even though you are using 200 pounds less, the mechanical work of the full squat is nearly triple that of the quarter squat. And metabolic stress is much greater because time under tension is much greater, due to the increased distance the weight is being moved.

There is certainly a place for some partials in training for overload and for working specific muscles and ranges of motion; however, the bulk of your movements should be through a full range of motion.

If you are scratching in disbelief because so many people lift with a limited range motion, the reason they do so is simple . . . ego!

Never engage in the self-indulgent practice of sacrificing technique for weight if you are serious about your strength goals.

Limiting Factors

For a bodybuilder, deadlifts serve to build the posterior chain, and barbell shrugs serve to build the traps. If your grip is the limiting factor in either of these exercises, wear straps. Obviously, you will want to build a strong grip but not at the expense of sacrificing muscular development.

If an exercise has a limiting factor that sacrifices the work the muscle performs, eliminate this factor (in this example, wear straps) or find a new exercise. The point is simple: if hypertrophy is the desired results, let the muscles you are

training limit the weight you use in training. Now that we know how to stimulate muscle hypertrophy, let's talk about what some of the best exercises for the bodybuilder are.

EMG Studies

Pioneering strength training researcher Bret Contreras has completed cutting-edge research on EMG activity for bodybuilders using innumerable popular exercises. (See Tables 4.1 through 4.4.)

EMG: Measures muscle response or electrical activity in response to a nerve's stimulation of the muscle.

EMG studies on strength training exercises are a dime a dozen, so what exactly makes Contreras special? Bret is a serious lifter who knows how to perform resistance exercises using the technique of an advanced bodybuilder.

Likewise, Bret performs exercises bodybuilders actually train with, making no safety judgments. Bret's agenda is simple: study the electrical activity of exercises bodybuilders use in training with the precision technique of a seasoned muscle head.

What Is EMG?

In 1849, Emil du Bois-Reymond discovered that it possible to record electrical activity during a voluntary muscle contraction. Electromyography (EMG) is a technique for evaluating and recording the electrical activity produced during voluntary contractions by skeletal muscles.

EMG started being used frequently in the 1960s in clinical settings; today, as technology evolves, EMG is increasingly being used. EMG uses a device called an electromyograph to produce a record called an electromyogram, which in turn measures the electrical activity of muscles during exercise.

Contreras says on his website, "EMG doesn't directly measure muscular tension; the two should be very similar (although slightly offset), as the electrical activity that EMG measures is simply a measurement of the nervous system's signal to the muscles. Increased EMG activity is indicative of the nervous system's attempt to produce more muscular force."

Although EMG is not the sole measure of the effectiveness of an exercise, it can aid in judging which exercises effectively work target muscles. Bret used primarily free weights in his research because that constitutes the bulk of his gym setup. All exercises were performed using weights Bret could perform five or more repetitions with to keep in the spirit of bodybuilding.

Mean EMG Activation: The average electrical activity of a muscle during the exercise performed.

Peak EMG Activation: The highest amount of electrical activity during the exercise.

What do **mean EMG activation** and **peak EMG activation** mean?

Mean EMG activation is simply the average electrical activity of a muscle during the exercise performed, whereas peak activations is the highest amount of electrical activity during the exercise. Researchers typically look at mean activation, as it is essentially tension throughout the movement, and peak is essentially the highest tensions in specific ranges of motion.

Table 4.1: EMG Results on Back and Biceps Exercises (Mean EMG listed first; peak EMG listed second)

Exercise	Long Head of Biceps (mean \ peak)	Lat (mean \ peak)	Mid Trap (mean \ peak)	Lower Trap (mean \ peak)
BW TRX Inverted Row	20.3 \ 33.4	51.1 \ 82.6	25.3 \ 41.8	25.6 \ 43.7
BW TRX Feet Elevated Inverted Row	21.2 \ 61.0	62.4 \ 124.0	24.8 \ 61.4	26.2 \ 53.6
25-lb. TRX Feet Elevated Inverted Row	27.7 \ 100.0	54.7 \ 138.0	52.2 \ 98.8	57.2 \ 101.0
BW Chin-up	43.2 \ 100.0	80.5 \ 133.0	32.2 \ 71.4	44.6 \ 101.0
BW Close Parallel Grip Pull-up	40.3 \ 90.4	82.5 \ 131.0	24.2 \ 58.0	31.6 \ 69.1
BW Wide Parallel Grip Pull-up	38.2 \ 90.2	75.6 \ 140.0	24.3 \ 62.6	32.5 \ 83.8
BW Wide Pronated Grip Pull-up	28.0 \ 65.8	85.5 \ 151.0	27.9 \ 63.3	33.4 \ 87.3
90-lb. Chin-up	107.0 \ 205.0	108.0 \ 159.0	41.9 \ 80.2	58.3 \ 104.0
70-lb. Wide Parallel Grip Pull-up	109.0 \ 184.0	75.3 \ 145.0	41.2 \ 79.1	50.9 \ 105.0
45-lb. Wide Pronated Grip Pull-up	65.8 \ 145.0	102.0 \ 167.0	33.4 \ 77.6	41.1 \ 115.0
315-lb. Rack Pull	7.4 \ 23.8	89.4 \ 152.0	71.7 \ 114.0	47.6 \ 86.1
405-lb. Rack Pull	6.8 \ 11.8	93.1 \ 163.0	67.4 \ 131.0	50.3 \ 90.9
185-lb. Overhand Grip Bent Over Row	8.6 \ 25.5	68.7 \ 130.0	62.2 \ 125.0	51.0 \ 110.0
185-lb. Underhand Grip Bent Over Row	19.1 \ 72.8	72.7 \ 134.0	58.6 \ 146.0	50.6 \ 130.0
225-lb. Overhand Grip Bent Over Row	18.4 \ 75.7	76.8 \ 140.0	67.5 \ 146.0	52.4 \ 112.0
225-lb. Underhand Grip Bent Over Row	41.6 \ 132.0	78.3 \ 146.0	61.9 \ 142.0	48.5 \ 116.0
90-lb. DB Bent Over Row	14.4 \ 73.6	63.0 \ 140.0	123.0 \ 226.0	99.0 \ 160.0
BW Overhand Grip Feet Elevated Inverted Row	14.9 \ 100.0	48.6 \ 119.0	54.5 \ 107.0	53.4 \ 103.0
BW Underhand Grip Feet Elevated Inverted Row	17.3 \ 82.4	69.4 \ 158.0	38.9 \ 86.7	33.3 \ 70.1
90-lb. DB Chest Supported Row	28.1 \ 135.0	87.4 \ 150.0	68.2 \ 134.0	59.8 \ 120.0
12-lb. Prone Trap Raise	18.3 \ 39.0	11.0 \ 22.1	72.5 \ 238.0	72.8 \ 170.0
25-lb. Prone Trap Raise	33.9 \ 94.1	15.9 \ 30.4	94.2 \ 186.0	81.6 \ 165.0
50-lb. DB Elbows out Chest-Supported Row	42.6 \ 78.8	24.6 \ 87.8	100.0 \ 194.0	71.9 \ 180.0
Blue Band Seated Row	27.5 \ 103.0	75.8 \ 128.0	53.9 \ 103.0	52.9 \ 77.7
280-lb. Underhand Grip Pull-down	22.3 \ 54.6	71.2 \ 129.0	22.7 \ 55.0	32.6 \ 74.0
240-lb. Wide Grip Pull-down	16.2 \ 52.9	63.5 \ 108.0	29.0 \ 56.6	38.8 \ 69.5
240-lb. Behind-Neck Wide-Grip Pull-down	23.7 \ 74.6	67.0 \ 117.0	23.6 \ 63.8	32.3 \ 85.6
260-lb. Narrow Parallel Grip Pull-down	22.9 \ 51.4	58.7 \ 97.5	29.9 \ 62.6	42.2 \ 87.4
80-lb. Pullover	2.1 \ 3.8	63.1 \ 106.0	20.0 \ 35.0	14.7 \ 22.3
100-lb. Straight Arm Pull-down	2.6 \ 5.3	65.1 \ 109.0	19.5 \ 39.4	21.5 \ 39.8
120-lb. Straight Arm Pull-down	3.2 \ 9.8	73.1 \ 131.0	17.1 \ 33.5	20.6 \ 37.9
220-lb. Seated Row	16.0 \ 69.7	48.0 \ 115.0	29.8 \ 55.0	28.7 \ 52.1
200-lb. Wide Grip Seated Row	24.0 \ 61.9	28.6 \ 58.4	50.6 \ 116.0	40.0 \ 70.1

Table 4.1: EMG Results on Back and Biceps Exercises continued				
Exercise	**Long Head of Biceps** (mean \ peak)	**Lat** (mean \ peak)	**Mid Trap** (mean \ peak)	**Lower Trap** (mean \ peak)
120-lb. Low Pulley Face Pull	20.5 \ 66.4	15.8 \ 43.3	43.3 \ 84.6	45.9 \ 79.4
120-lb. Mid Pulley Face Pull	18.2 \ 77.5	20.5 \ 51.4	45.8 \ 83.0	53.1 \ 97.5
120-lb. High Pulley Face Pull	10.9 \ 51.5	23.6 \ 85.1	46.3 \ 82.6	54.1 \ 87.9
Band Face Pull	13.2 \ 28.7	14.1 \ 29.6	37.0 \ 68.3	60.3 \ 109.0
100-lb. One-Arm Row	33.1 \ 85.1	77.2 \ 143.0	84.3 \ 129.0	66.8 \ 139.0
150-lb. Standing Cable One-Arm Row	18.8 \ 52.6	72.0 \ 131.0	40.3 \ 73.4	41.1 \ 77.5
JC Band Row	10.2 \ 46.3	55.0 \ 96.3	30.7 \ 73.7	35.9 \ 54.5
60-lb. DB Curl	52.9 \ 118.0	21.0 \ 72.7	68.7 \ 161.0	43.8 \ 88.8
95-lb. BB Curl	64.9 \ 98.3	14.0 \ 23.2	50.6 \ 88.3	34.2 \ 57.6
115-lb. BB Curl	77.1.0 \ 119.0	15.7 \ 46.0	62.6 \ 102.0	42.5 \ 69.1
135-lb. BB Curl	94.7 \ 138.0	17.2 \ 50.9	66.8 \ 106.0	44.9 \ 69.7
155-lb. BB Cheat Curl	93.9 \ 136.0	21.3 \ 53.1	73.0 \ 150.0	47.9 \ 105.0
85-lb. Reverse Curl	34.0 \ 77.8	12.0 \ 20.0	64.6 \ 93.2	49.5 \ 65.8
50-lb. Hammer Curl	47.8 \ 98.1	11.8 \ 18.3	52.3 \ 109.0	37.7 \ 84.5
60-lb. Hammer Curl	54.9 \ 105.0	15.1 \ 22.8	55.4 \ 92.4	43.0 \ 77.1
115-lb. Easy Bar Curl	74.7 \ 146.0	11.7 \ 19.2	72.4 \ 110.0	56.1 \ 78.4
50-lb. One-Arm Preacher Curl	80.0 \ 145.0	12.5 \ 26.7	48.9 \ 95.4	37.3 \ 71.9
50-lb. Concentration Curl	76.1 \ 143.0	20.9 \ 54.1	47.3 \ 85.6	33.9 \ 63.1
30-lb. DB Incline Curl	53.6 \ 109.0	15.8 \ 34.7	26.8 \ 61.1	20.6 \ 46.3

Bret's research demonstrated that the greatest mean activation for biceps was with weighted wide-grip pull-ups, weighted chin-ups, and the barbell curl.

Peak activation was achieved with the weighted chin-up, weighted wide-grip parallel-grip pull, and bicep curls with the EZ Curl Bar. It may come as a surprise to many that direct biceps work did not top the charts.

Top bodybuilders and gym rats who sport biceps that have reached behemoth proportions favor cheat curls over strict isolation curls and machines for biceps growth.

This is contrary to what you hear and to the recommendations of pseudo science.

Take it from a musclehead who has spent his life in the trenches—this is reality!

Arnold Schwarzenegger broke the mold and implemented cheat curls. Those who called him nuts back then eventually had to call him "champ," setting a new standard by winning six straight (and seven total) Mr. Olympia titles.

Today, many would view it as crazy not to jump onboard with the man who quite possibly developed the greatest pair of biceps of all time. Whether we're talking about Bill Kazmaier or Ronnie Coleman, cheat curls have played a role morphing arms into superhero proportions.

Chin-up variations was the topic. What do cheat curls have to do with that?

As discussed in the previous unit, while performing chin-ups, the back assists, similar to "cheating" in the cheat curl when hip swing gives you momentum to circumvent your sticking

point; with the chin-up, your upper back pushes you past your sticking point.

Bring logic into play: We know compound movements build big muscles, increase inter-muscular coordination, increase intra-muscular coordination, and release the anabolic hormones that induce hypertrophy. Chin-ups are compound.

Obviously, this doesn't account for everything that determines the value of an exercise, and the overload principle of isolation does not hold true. But a heavy movement that places a huge load on the biceps cannot be dismissed.

For the lats, peak activation was achieved with the weighted wide-grip pronated (overhand) pull-up, reverse-grip feet elevated inverted row, and rack pulls.

The highest mean activation was achieved with the rack pull, weighted chin-up, and weighted wide-grip pull-up. This is not surprising. This also shows the value of chin-up variations.

It is great for science to confirm what those in the trenches have known for years, which is that deadlift variations and weighted chin-up/pull-up variations build the back like no other exercise does. Ronnie Coleman reached his best without knowledge of this research, but he abided by these principles and arguably built the best back of all time.

The mid traps had the highest mean activation with dumbbell bent-over row, dumbbell chest supported row, and prone trap raise. Peak activation was achieved with the same exercises.

Deadlift variations, weighted chin-up variations, and a rowing variation look similar to the regimen of King Coleman. Lower traps produced mean and peak activation with the same exercises.

These exercises are worth seriously considering for back work. Deadlifts, rows, and chin-ups build the back. Champions prove it in the trenches, and science confirms it.

Table 4.2: EMG Results on Shoulder and Trap Exercises (Mean EMG listed first; peak EMG listed second)				
Exercise	**Upper Trap** (mean \ peak)	**Anterior Delt** (mean \ peak)	**Lateral Delt** (mean \ peak)	**Posterior Delt** (mean \ peak)
45-lb. Standing Military Press	60.1 \ 117.0	65.5 \ 145.0	8.9 \ 23.7	4.0 \ 8.3
135-lb. Standing Military Press	56.1 \ 99.0	120.0 \ 266.0	23.9 \ 68.0	7.6 \ 16.7
155-lb. Standing Military Press	47.4 \ 82.3	131.0 \ 315.0	25.4 \ 86.6	7.8 \ 18.8
175-lb. Standing Military Press	53.4 \ 81.2	150.0 \ 281.0	34.0 \ 87.7	9.6 \ 21.5
155-lb. Standing Behind Neck Press	66.5 \ 94.0	146.0 \ 318.0	45.7 \ 88.7	13.9 \ 23.6
70-lb. DB Standing Military Press	51.6 \ 93.0	174.0 \ 432.0	43.3 \ 111.0	14.5 \ 43.1
135-lb. Seated Shoulder Press	65.6 \ 98.1	120.0 \ 221.0	23.8 \ 58.9	7.9 \ 14.9
185-lb. Seated Shoulder Press	67.2 \ 91.6	190.0 \ 311.0	48.7 \ 94.3	13.2 \ 19.9
165-lb. Seated Behind Neck Press	72.1 \ 110.0	274.0 \ 471.0	69.5 \ 106.0	17.6 \ 27.8
80-lb. Seated DB Shoulder Press	60.5 \ 106.0	162.0 \ 328.0	43.5 \ 87.3	13.8 \ 21.4
50-lb. DB Upright Row	58.4 \ 113.0	60.6 \ 119.0	56.1 \ 102.0	54.3 \ 103.0
60-lb. DB Upright Row	38.2 \ 59.9	57.8 \ 146.0	61.6 \ 96.3	71.1 \ 138.0
75-lb. Cable Upright Row	60.7 \ 109.0	37.4 \ 92.6	46.5 \ 87.6	54.0 \ 147.0
135-lb. BB Upright Row	53.7 \ 67.4	96.6 \ 204.0	68.0 \ 102.0	80.9 \ 155.0
95-lb. BB Upright Row	64.3 \ 91.9	69.9 \ 125.0	54.7 \ 100.0	65.6 \ 139.0
30-lb. Lateral Raise	49.2 \ 83.2	80.8 \ 170.0	73.4 \ 148.0	63.5 \ 113.0
40-lb. Lateral Raise	41.7 \ 77.3	113.0 \ 191.0	83.1 \ 141.0	73.3 \ 134.0
50-lb. Lateral Raise	44.9 \ 101.0	114.0 \ 213.0	84.3 \ 124.0	66.3 \ 133.0
40-lb. Cable Lateral Raise	75.5 \ 150.0	55.2 \ 163.0	58.4 \ 136.0	64.2 \ 121.0
30-lb. DB Front Raise	66.4 \ 104.0	105.0 \ 202.0	49.4 \ 76.1	39.5 \ 84.5
55-lb. BB Front Raise	64.4 \ 101.0	99.3 \ 170.0	36.8 \ 70.5	31.1 \ 74.3
30-lb. DB Bent-Over Rear Delt Raise	31.2 \ 79.0	13.8 \ 42.7	46.9 \ 103.0	94.2 \ 182.0
50-lb. DB Bent-Over Rear Delt Raise	40.3 \ 87.6	19.4 \ 41.6	60.5 \ 108.0	94.7 \ 153.0
25-lb. DB Prone Rear Delt Raise	43.9 \ 91.1	18.7 \ 53.3	64.3 \ 126.0	88.9 \ 152.0
30-lb. Cable Scarecrow	50.9 \ 98.8	29.1 \ 68.7	62.8 \ 130.0	93.8 \ 167.0
BW Push-up	11.6 \ 29.9	88.3 \ 175.0	12.9 \ 24.5	5.7 \ 12.1
225-lb. Bench Press	4.8 \ 20.5	97.8 \ 201.0	7.0 \ 17.3	5.8 \ 8.4
BW Dip	3.3 \ 9.8	21.1 \ 39.2	3.1 \ 4.7	9.8 \ 20.6
225-lb. Incline Press	40.5 \ 69.1	184.0 \ 390.0	24.9 \ 45.5	7.9 \ 11.7
BW Pull-up	17.8 \ 56.3	14.1 \ 35.4	4.5 \ 14.4	19.1 \ 53.2
BW Chin-up	12.7 \ 42.9	15.1 \ 74.7	6.4 \ 33.0	17.2 \ 64.9
BW Hanging Row	12.9 \ 24.4	12.2 \ 33.2	35.7 \ 79.6	87.1 \ 182.0
100-lb. DB Shrug	29.2 \ 57.7	9.1 \ 22.2	20.2 \ 39.7	42.6 \ 93.6
50-lb. DB Shrug	39.5 \ 62.9	10.3 \ 23.3	11.9 \ 21.6	27.2 \ 54.1
120-lb. Face Pull	69.7 \ 101.0	16.8 \ 29.2	55.0 \ 92.8	87.1 \ 159.0
Band Face Pull	60.1 \ 77.1	21.1 \ 37.1	90.7 \ 152.0	144.0 \ 252.0
225-lb. BB Shrug	76.1 \ 118.0	17.0 \ 31.5	9.9 \ 18.5	29.6 \ 66.0
225-lb. Behind Back Shrug	39.5 \ 67.1	11.6 \ 21.1	19.3 \ 38.2	45.1 \ 71.6
315-lb. BB Shrug	81.9 \ 145.0	18.0 \ 32.1	24.6 \ 46.8	48.3 \ 72.8

For the anterior (front deltoids), mean EMG activity reached its highest levels with the seated behind the neck press, seated military press, and the incline press.

Peak activation was reached with the seated behind-the-neck press, standing dumbbell military press, and the incline press. Essentially, this says that to maximally hit the front delts, you need to include heavy presses.

This is also interesting because many experts in the field have forewarned iron enthusiasts to avoid all behind the neck pressing, yet some old-timers swear by the exercise.

Although there is a risk of increased injury, there is a benefit as well. Fortunately there are other exercises to choose from that will stimulate the anterior deltoids. These are all pressing exercises that target the anterior delts; the medial and posterior portions are what sometimes lack in heavy pressers.

Light was also shed on the incline press. It is widely known this movement is great for upper chest development, but lo and behold, inclines disperse a huge load on the shoulders.

The crucial point is that, if your shoulders overpower your chest, you may want to avoid this exercise because your shoulders will greatly overpower chest involvement. Heavy presses are the recipe to follow to maximize shoulder development!

For the medial (side delts), Contreras's experiments yielded these results: The highest mean activation was with band face pull, lateral raise, and seated behind-the-neck press. Peak activation was achieved with band face pull, lateral raise, and cable lateral raise.

It is no surprise that lateral raises in two variations made this list; the big surprise was the face pull. The face pull is generally thought of as a rear delt exercise, but it clearly provides great tension to the medial delts, demonstrating the face pull's exercise value. Presses, lateral raises, and face pulls hold the keys to unlock monstrous shoulder development.

For the rear delts, mean activation was highest with the band face pull, bent-over rear delt raise, and prone rear delt raise. Peak activation was highest with band face pull, bent-over rear delt raise, and hanging row.

These were to be expected. It doesn't get more basic than heavy shoulder presses, lateral raises, face pulls, and bent-over flyes. Basic here gets the job done.

Upper trap mean activation was highest with the barbell shrug, cable lateral raise, and standing military press. Peak activation was achieved through cable lateral raise, barbell shrug, and seated behind the neck press.

I was not surprised to hear about the standing military presses. They are not thought of as a direct trap movement, but anecdotally speaking, I have noticed with clients and myself that, when training the press heavy regularly, imposing traps do in fact result.

Chest and Triceps

Like other EMG experiments, chest and triceps confirmed some of the obvious and offered some surprises.

Contreras did a great job of testing some of today's most popular bodybuilding exercises and some classic forgotten favorites, as shown in Table 4.3.

For the upper chest, the greatest mean EMG activity was achieved via the mid pulley crossover, band push-up, and JC press. The peak was with the dumbbell incline press, guillotine press, and JC band press (a standing resistance band press).

For the mid-pec, the greatest mean activation was achieved with the floor press, dumbbell bench press, and flye. Peak activation was the

Table 4.3: EMG Results on Chest and Triceps Exercises
(Mean EMG listed first; peak EMG listed second)

Exercise	Upper Pec (mean \ peak)	Mid Pec (mean \ peak)	Lower Pec (mean \ peak)	Tri Long Head (mean \ peak)
135-lb. Bench Press	53.8 \ 111.0	69.5 \ 157.0	42.0 \ 82.7	14.3 \ 51.2
225-lb. Bench Press	125.0 \ 230.0	181.0 \ 408.0	116.0 \ 347.0	47.8 \ 109.0
275-lb. Bench Press	109.0 \ 198.0	177.0 \ 288.0	130.0 \ 345.0	73.5 \ 153.0
135-lb. Incline Press	87.1 \ 157.0	68.3 \ 197.0	25.3 \ 60.2	18.9 \ 42.7
225-lb. Incline Press	135.0 \ 222.0	133.0 \ 374.0	69.4 \ 249.0	48.7 \ 84.0
245-lb. Incline Press	130.0 \ 261.0	156.0 \ 422.0	89.4 \ 337.0	55.8 \ 109.0
100-lb. DB Bench Press	122.0 \ 192.0	204.0 \ 451.0	88.1 \ 252.0	43.7 \ 128.0
90-lb. DB Incline Press	128.0 \ 310.0	124.0 \ 286.0	59.0 \ 172.0	35.5 \ 98.9
BW Dip	73.7 \ 164.0	105.0 \ 234.0	124.0 \ 266.0	73.9 \ 150.0
115-lb. Dip	140.0 \ 232.0	192.0 \ 332.0	214.0 \ 418.0	124.0 \ 217.0
225-lb. Close-Grip Press	106.0 \ 211.0	137.0 \ 229.0	77.5 \ 217.0	52.6 \ 107.0
225-lb. Wide-Grip Guillotine Press	114.0 \ 302.0	176.0 \ 511.0	169.0 \ 502.0	61.9 \ 142.0
225-lb. Floor Press	106.0 \ 197.0	148.0 \ 248.0	121.0 \ 255.0	52.2 \ 112.0
275-lb. Floor Press	132.0 \ 265.0	197.0 \ 356.0	154.0 \ 347.0	64.8 \ 170.0
50-lb. Flye	116.0 \ 226.0	165.0 \ 354.0	150.0 \ 387.0	13.2 \ 26.1
60-lb. Flye	133.0 \ 231.0	195.0 \ 493.0	160.0 \ 450.0	14.9 \ 31.3
50-lb. Incline Flye	125.0 \ 249.0	135.0 \ 344.0	77.3 \ 257.0	12.6 \ 20.0
100-lb. High Pulley Crossover	107.0 \ 201.0	168.0 \ 311.0	153.0 \ 397.0	9.6 \ 19.1
100-lb. Mid Pulley Crossover	154.0 \ 252.0	154.0 \ 271.0	124.0 \ 251.0	11.5 \ 23.1
100-lb. Low Pulley Crossover	135.0 \ 233.0	78.6 \ 249.0	36.9 \ 74.8	20.2 \ 77.2
BW Push-up	109.0 \ 204.0	124.0 \ 252.0	101.0 \ 194.0	24.0 \ 38.7
BW CG Push-up	103.0 \ 188.0	118.0 \ 188.0	70.7 \ 119.0	22.9 \ 43.2
BW Elevated Push-up	96.6 \ 156.0	102.0 \ 232.0	52.7 \ 167.0	24.0 \ 46.6
BW Blast Strap Push-up	113.0 \ 206.0	166.0 \ 363.0	177.0 \ 352.0	35.3 \ 107.0
Purple Band Push-up	115.0 \ 168.0	125.0 \ 294.0	113.0 \ 217.0	51.8 \ 78.7
Green Band Push-up	151.0 \ 239.0	162.0 \ 268.0	121.0 \ 238.0	59.3 \ 125.0
100-lb. DB Pullover	55.7 \ 119.0	88.6 \ 186.0	53.8 \ 164.0	66.9 \ 153.0
JC Band Press	143.0 \ 272.0	45.7 \ 91.0	53.0 \ 127.0	21.0 \ 52.6
95-lb. Skull Crusher	45.6 \ 89.5	21.5 \ 48.6	70.7 \ 118.0	116.0 \ 172.0
120-lb. Rope Extension	6.9 \ 14.9	5.4 \ 21.9	36.1 \ 82.5	135.0 \ 276.0
140-lb. Cable Extension	9.3 \ 21.3	9.3 \ 18.7	78.2 \ 172.0	132.0 \ 255.0
Purple Band Extension	11.4 \ 27.4	10.7 \ 19.5	69.4 \ 174.0	120.0 \ 221.0
140-lb. Cable Overhead Extension	19.4 \ 41.0	19.2 \ 130.0	40.6 \ 126.0	109.0 \ 206.0

highest with the guillotine press, dumbbell bench press, and flye.

For the lower portion of the chest, the greatest mean activation was achieved with the weighted dip, blast strap push-up, and the guillotine press; the highest peak activation was achieved with the guillotine press, flye, and weighted dip.

For the long head of the triceps, the greatest

mean activation was by way of the rope extension, cable extension, and weighted dip. The most pronounced peak activation was achieved through peak rope extension, cable extension, and band extension.

The guillotine press really hammered the chest! This was straight out of the playbook of old-time bodybuilding guru Vince Gironda.

The movement is a variation of the bench press, except the feet are on the bench, absolutely no arch, and the elbow is flared out; the bar is brought down to your neck, and a very wide grip is used.

The obvious advantage to this movement is the direct chest work; the disadvantages are the potential for injury and lighter weights that have to be used.

The JC band presses use bands instead of weight; but to my knowledge, no one has built a championship physique with just bands.

The dumbbell pullover, though lacking a huge mean activation, had great peak activation across all parts of the chest and the triceps.

Dips were another very economical exercise stressing both chest and triceps. Dumbbell pullovers provide a great stretch and build muscle that will help provide the illusion of a great chest.

I was very surprised to see how well triceps isolation exercises stacked up against compound movements.

Legs

No bodybuilding experiment would be complete without the top leg exercises.

Let's look at Table 4.4 for Contreras's EMG research that can aid you in building a great set of wheels.

For the quads, squats are king, as any hardworking bodybuilder will attest. Some recent research has indicated that quad activation was similar in

Table 4.4: EMG Results on Leg Exercises (Mean EMG listed first; peak EMG listed second)

Exercise	Glute Max (Glutes) (mean \ peak)	Vastus Lateralis (Quadriceps) (mean \ peak)	Adductor Logis (Adductors) (mean \ peak)	Biceps Femoris (Hamstrings) (mean \ peak)
275-lb. High Bar Full Squat	24.4 \ 58.0	96.0 \ 194.0	37.2 \ 79.2	36.4 \ 77.9
275-lb. High Bar Parallel Squat	18.9 \ 46.6	99.9 \ 189.0	38.1 \ 93.5	38.3 \ 61.8
315-lb. High Bar Half Squat	28.3 \ 70.0	101.0 \ 153.0	32.4 \ 65.4	40.3 \ 89.6
365-lb. High Bar Quarter Squat	26.0 \ 65.2	97.1 \ 160.0	29.3 \ 54.3	36.5 \ 64.7
275-lb. Low Bar Low Box Squat	18.2 \ 68.7	83.6 \ 153.0	31.5 \ 74.9	32.3 \ 72.6
295-lb. Low Bar High Box Squat	21.0 \ 50.6	83.1 \ 146.0	32.0 \ 75.1	35.0 \ 69.9
295-lb. Low Bar Wide Stance Parallel Squat	25.1 \ 63.3	77.2 \ 120.0	32.3 \ 71.9	41.8 \ 107.0
295-lb. Low Bar Narrow Stance Parallel Squat	19.1 \ 57.8	69.1 \ 135.0	28.1 \ 62.9	32.1 \ 77.2
275-lb. Zercher Squat	44.6 \ 99.3	75.6 \ 116.0	24.8 \ 48.0	43.5 \ 84.0
290-lb. Lever Machine Squat	23.3 \ 62.4	70.0 \ 101.0	30.1 \ 54.0	29.8 \ 52.8
225-lb. Belt Squat	18.3 \ 37.4	57.9 \ 114.0	25.6 \ 41.0	26.1 \ 39.4
270-lb. Straddle Lift	41.3 \ 84.4	59.2 \ 113.0	31.6 \ 75.9	52.4 \ 101.0
225-lb. Front Squat	30.8 \ 71.3	74.3 \ 152.0	35.0 \ 67.1	37.6 \ 90.4
405-lb. Deadlift	52.6 \ 72.9	50.6 \ 75.8	27.8 \ 56.1	105.0 \ 179.0
405-lb. Sumo Deadlift	58.1 \ 119.0	60.6 \ 107.0	29.3 \ 81.1	85.1 \ 153.0

Table 4.4: EMG Results on Leg Exercises continued				
Exercise	**Glute Max (Glutes)** (mean \ peak)	**Vastus Lateralis (Quadriceps)** (mean \ peak)	**Adductor Logis (Adductors)** (mean \ peak)	**Biceps Femoris (Hamstrings)** (mean \ peak)
365-lb. Foot Elevated Deadlift	24.9 \ 66.6	47.4 \ 77.2	22.1 \ 64.6	56.7 \ 138.0
405-lb. Hex Bar Deadlift	38.8 \ 91.9	68.0 \ 102.0	28.4 \ 74.6	69.3 \ 144.0
315-lb. Hack Lift	33.2 \ 91.7	80.2 \ 158.6	47.9 \ 82.5	34.0 \ 66.5
365-lb. Romanian Deadlift	28.2 \ 49.0	35.4 \ 74.6	37.3 \ 163.0	78.9 \ 145.0
455-lb. Rack Pull	44.4 \ 78.8	39.5 \ 71.8	16.8 \ 35.2	105.0 \ 181.0
180-lb. Single Leg RDL	31.5 \ 63.2	56.4 \ 83.6	31.0 \ 85.4	71.4 \ 150.0
225-lb. Good Morning	30.7 \ 45.7	35.5 \ 71.1	25.0 \ 49.9	67.1 \ 123.0
225-lb. Lever Machine Good Morning	29.7 \ 49.6	29.9 \ 54.5	22.6 \ 43.5	58.9 \ 114.0
405-lb. Hip Thrust	60.3 \ 138.0	88.5 \ 165.0	26.0 \ 50.4	75.1 \ 152.0
495-lb. Glute Bridge	65.3 \ 142.0	53.1 \ 90.3	17.5 \ 30.4	77.7 \ 130.0
Red Band Single Leg Hip Thrust	51.1 \ 88.1	65.3 \ 99.9	19.6 \ 37.5	51.9 \ 102.0
Blue Band Skorcher Hip Thrust	88.3 \ 160.0	89.3 \ 172.0	22.4 \ 41.7	40.3 \ 113.0
225-lb. Reverse Lunge	31.1 \ 82.7	70.4 \ 99.2	42.3 \ 68.5	46.3 \ 109.0
185-lb. Bulgarian Squat	42.2 \ 79.0	84.8 \ 131.0	45.4 \ 69.6	55.8 \ 98.6
155-lb. Low Step Up	23.2 \ 64.1	55.2 \ 137.0	25.9 \ 99.0	27.3 \ 86.7
30-lb. High Step Up	25.6 \ 137.0	39.7 \ 85.4	29.6 \ 104.0	20.6 \ 54.1
20-lb. Single Leg Squat	26.9 \ 41.3	65.5 \ 93.8	41.3 \ 69.6	27.4 \ 44.2
135-lb. Back Extension	46.1 \ 89.8	3.3 \ 5.1	12.5 \ 17.6	92.5 \ 137.0
2 Red Band Back Extension	41.5 \ 92.0	3.9 \ 7.3	9.8 \ 14.2	80.6 \ 151.0
50-lb. Single Leg Back Extension	37.6 \ 85.6	4.9 \ 10.0	13.5 \ 20.5	93.0 \ 151.0
100-lb. Bent Leg Back Extension	55.8 \ 114.0	6.5 \ 22.3	9.7 \ 15.4	55.4 \ 88.1
135-lb. 45-Degree Hyper	43.1 \ 82.4	3.6 \ 7.1	11.4 \ 16.8	83.8 \ 141.0
3 Red Band 45-Degree Hyper	42.9 \ 91.9	3.8 \ 6.1	8.8 \ 12.3	84.0 \ 121.0
50-lb. Single-Leg 45-Degree Hyper	44.4 \ 94.3	4.8 \ 10.5	13.2 \ 21.7	82.0 \ 152.0
BW Hanging Single-Leg Straight-Leg Bridge	35.3 \ 94.8	3.0 \ 4.8	29.8 \ 52.6	96.0 \ 154.0
BW Single-Leg Gliding Leg Curl	35.0 \ 66.2	8.0 \ 38.1	61.6 \ 120.0	76.5 \ 131.0
280-lb. Cable Pull Through	61.0 \ 129.0	23.9 \ 46.0	21.6 \ 78.2	31.9 \ 70.0
30-lb. Glute Ham Raise	18.0 \ 48.6	13.2 \ 35.0	42.9 \ 81.8	82.1 \ 164.0
20-lb. Bird Dog	56.9 \ 108.0	4.8 \ 12.2	14.0 \ 28.1	82.0 \ 173.0
BW Russian Leg Curl	7.0 \ 29.7	3.6 \ 7.5	46.5 \ 80.3	64.3 \ 94.0
BW Slideboard Leg Curl	11.7 \ 34.3	4.2 \ 7.0	46.2 \ 81.7	78.8 \ 129.0
115-lb. Pendulum Quadruped Hip Extension	55.3 \ 93.1	72.3 \ 143.0	15.0 \ 24.7	24.7 \ 50.0
115-lb. Pendulum Donkey Kick	52.2 \ 82.2	82.4 \ 171.0	19.1 \ 44.4	21.8 \ 44.4
140-lb. Single- Leg Reverse Hyper	43.3 \ 110.0	7.5 \ 15.0	20.1 \ 65.7	81.3 \ 145.0
140-lb. Bent-Leg Reverse Hyper	35.9 \ 94.2	3.9 \ 5.7	29.2 \ 51.4	67.3 \ 93.5
270-lb. Reverse Hyper	56.7 \ 103.0	9.2 \ 28.6	15.3 \ 34.6	70.3 \ 110.0

both bodybuilding stance squats and powerlifting stance squats.

Bret, an experienced lifter, showed greater quad activation with bodybuilder style squats and greater hamstring activation with a powerlifter wider stance, low-bar squat technique.

Zercher squats, considered archaic by many, worked the glutes more effectively than more traditional squat variations did. Surprisingly, deadlifts and rack pulls were some of the top hamstring exercises and hip-thrusting motions and provided the greatest glute activation. Some other surprises were that good mornings did not cause greater hamstring activation, and lunges did not cause greater glute activation.

The Future of EMG and Bodybuilding

EMG is not gospel when it comes to exercise selection. We must also look at the stretch induced, resistance used, metabolic cost of the exercise, muscle damage caused, and, of course, the safety of the exercises. Hats off to Bret and his research that has provided us with a helpful tool in exercise selection.

TOP TEN EXERCISES FOR LEGS

Nothing looks sillier than a pair of chicken legs coupled with a massive upper body. Increasing emphasis is being placed on lower body development in today's contests. Size, separation, and even striated glutes have become the norm in high-level contests.

SQUATS (FRONT AND BACK)

"There is simply no other exercise, and certainly no machine, that produces the level of central nervous system activity, improved balance and coordination, skeletal loading and bone density enhancement, muscular stimulation and growth, connective tissue stress and strength, psychological demand and toughness, and overall systemic conditioning than the correctly performed full squat," said strength coach Mark Rippetoe.

He was right.

Squats are indeed king.

How to correctly perform a back squat:

1. Place a barbell on top of the posterior deltoids
2. Un-rack the barbell and step back one leg at a time to a shoulder width or wider stance
3. Keep your chest up and shoulder blades retracted
4. Initiate movement by pushing your hips back (don't bend at the knees first)
5. Make sure to push your knees out on the descent and ascent
6. Squat down below parallel
7. Return to the starting position

Safety squats with a safety bar will allow you to squat with more weight, maintain a more upright position, and pull yourself through sticking points,—ceasing assistance at points where leverage is advantageous—where you are the strongest.

Unfortunately, most gyms do not have safety bars. As we will discuss in the next unit, regular back squats can be performed with additional bands or chains. Total band or chain weight should be 10%–25% of bar weight.

If you are squatting 300 pounds of bar weight, this means an additional 30–75 pounds of total band and chain weight can be added to the bar.

Bands can also be tied to the top of the rack in a reverse-band style using the same guidelines.

Important note: When performing heavy squats, you need to breathe before the initial descent and between reps. When squatting, perform the Valsalva Maneuver. This is done by exhaling against a closed glottis; this increases intra-abdominal pressure and allows you to have a more rigid torso and produce more force. There is not one shred of evidence of ill health effects in healthy adults performing this maneuver. Quite the contrary: This is an injury-prevention and strength-enhancing movement. However, those with high blood pressure should avoid the Valsalva Maneuver and heavy squats due to the temporary rapid rise in blood pressure that the Valsalva Maneuver triggers.

How to correctly perform a front squat:

Front squat technical cues are similar to those of back squats.

1. Place the barbell on your shoulders; it should be very close to your neck.
2. Un-rack the bar with a clean grip or a body-builder "California Style" cross grip.
3. Keep your arms crossed in front of you and at parallel position to the floor to prevent the barbell from rolling forward and away from your neck.
4. Keep your chest up throughout the entire movement.
5. Initiate movement by pushing your hips back. (Don't bend at the knees first.)
6. Make sure to push your knees out on the descent and ascent.
7. Squat down to the position of at least parallel or below parallel.
8. Return to the starting position.

Advantages of the front squat:

1. Front squats are more quad dominant. Don't worry if your front squat poundages are less than what you use for the back squat. You will see and feel the front-squat difference!

2. Front squats are easier on your back because your torso is more erect and, obviously, less weight is being handled.
3. If you go forward on a front squat, you lose the weight; so it's impossible to lean forward too excessively.
4. Front squats are also a good tool to teach someone to back squat with an erect torso.
5. Front squats offer great transference to jerks, push presses, and Olympic lifts; more core stabilization is required than for back squats.

Important note: Like back squats, front squats should be performed with the Valsalva Maneuver. Front squat harnesses are now available, and those who use them swear by them, making the holding-in-the-rack position a non-issue. I recommend not front squatting above eight reps because your rhomboids will fatigue before your thighs do, so you will start to gain a hunchback-like posture. Front squats can be done with chains; against bands, they feel quite awkward.

LUNGES

How to correctly perform a lunge:

1. Hold a dumbbell in each hand or place a barbell on your back.
2. Step forward with one leg, keeping your torso upright.
3. Make a 90-degree angle with the leg that is in front.
4. Be careful not to let your knee go over your toe.
5. Return to starting position.

Important note: Lunges can also be performed in a reverse style or even laterally. Walking

lunges were a favorite of eight-time Mr. Olympia, Ronnie Coleman.

In Ronnie Coleman's prime, he did walking lunges of 405 pounds for a 50-yard lunge! To quote Brian Dobson, "The walking lunge has now

become standard for upper leg separation and glute/ham tie-in." Lunge variations not only assist in total leg development but also strengthen the core and increase stability in heavy squatting.

ANGLED LEG PRESS

The leg press, though an excellent exercise, is not a substitute for the king of all leg exercises, the squat.

How to correctly perform an angled leg press:

1. Sit on the machine with your head and back against the padded support.
2. With your feet on the platform, tighten your abdominals.
3. Push the platform away from your body by extending your knees and pushing your hips back into the pad.
4. Make sure your heels remain flat on the footplate.
5. Do not lift your lower back or butt off the platform.
6. Bring the weight down so your knees are past 90 degrees.
7. Push the weight back up to starting position.

Important note: The lower you place your feet on the platform, the more intensely you hit the quads. By putting your feet higher on the platform and farther apart, you will more directly hit your glutes and hamstrings.

This is a huge ego lift for many folks; do not fall into this trap by loading hundreds of pounds onto the leg press and moving it just a couple of inches.

Because of the lack of stabilization required to perform the leg press and the fantastic leverage, you can use a great deal of weight, which could potentially be harmful because of the fixed motor pattern and the amount of weight your joints need to handle.

Ronnie Coleman, Johnnie Jackson, and Branch Warren all feel that they get the most out of this exercise with high reps. Bodybuilding guru and Metroflex owner Brian Dobson preaches the same and has been known to do a four-set routine of leg presses of 50, 40, 30, 20 repetitions.

No one cares how much you can leg press, and it is not a valid test of limit strength. This movement should be used correctly to build your thighs, not your ego.

BARBELL HIP THRUSTS

Glute development, unlike past eras, is essential to win the big shows. One of the best exercises for the glutes is the barbell hip thrust.

I learned of this exercise from Bret Contreras. It directly targets the glutes, and heavy weight can be used. From a strength standpoint, this will enhance the deadlift lockout or any hip-thrusting motion.

How to correctly perform a barbell hip thrust:

1. Start with your body seated on the ground, with your back rested upon a bench.
2. Make sure the bench won't move.
3. Place a weighted barbell on your hips.
4. If you have large hips, plates can be stacked under the loaded weights to give you extra room.
5. From here, lean your shoulders back against the bench with your shoulders resting on top of the bench.
6. Forcefully push your hips up vertically, keeping the bar resting in your pelvis region.
7. Hold this top position briefly.
8. Return to starting position.

SINGLE LEG CABLE KICKBACKS

This isolation exercise is extremely effective for targeting the glutes.

How to correctly perform single-leg cable kickbacks:

1. Hook a cuff around the ankle. (You can use ab straps or even free motion handles.)
2. Face the weight stack and stand approximately 2–3 feet from it.
3. Hold the steel supports to balance yourself.
4. Slightly bend your knees and tighten your abdominals.

5. Using the leg that has the cuff, kick back as far as you can.
6. Hold your leg at that position for a second to get a good peak contraction.
7. Return to the starting position.

Important note: This exercise can also be done with resistance bands. Bodybuilders will spend hours trying to isolate the biceps, but glutes deserve high priority, too.

GLUTE HAM RAISES

Glute ham raises are a favorite of those in strength sports to achieve performance increases in pulls and squats. Bodybuilders need to get onboard! This compound movement is one of the most effective ways to target the glutes and hamstrings.

How to correctly perform a glute ham raise:

1. Place the ankles between the roller pads; your feet should be on the vertical platform.

2. If you are sweaty, place a towel on the platform to prevent slipping.
3. Your knees will be on the pad, and the lower portion of your thighs will be wedged against the large arc-shaped pad.
4. Initiate the movement by lifting your torso with your hamstrings and extending your hips with your glutes.
5. Keep raising your body by flexing your knees until your torso is upright.
6. Lower yourself in the opposite manner.

Important note: This movement is like a compound leg curl that highly engages the glutes. It is a compound movement because knee flexion and hip extension both take place.

Initially, your body weight will be difficult, and many will not be able to do their bodyweight. In this case, you can do them band assisted, working up to your body weight.

When you become proficient, you can add resistance by placing a barbell behind your shoulders like a squat, holding a weight or going against resistance bands. Originally, this machine was called the glute-ham-gastroc machine because it even hits the calves.

Believe the hype—it works!

DEADLIFT HYPER

This movement could be classified as a back movement, as even the glutes play an important assisting role. This is one of the most effective exercises to build and strengthen the hamstrings.

How to correctly perform a deadlift hyper:

1. On a 45-degree hyper bench, place your thighs face down on the padding.

2. Your feet should be flat on the bottom support platform.
3. Place the barbell or dumbbells in your hands, keeping your back flat throughout the entirety of the movement.
4. Lift your body upward until your hips are extended, squeezing your glutes as you lockout the weight.
5. Lower the weight back to the floor.

Important note: If you are unable to achieve a full range of motion because your hyper bench is too low to the ground, use small plates. Instead of a 45-pound plate on each side, use a 25-pound plate, with two 10s or even four 10s and a 5.

Many with lower back problems have used non-weighted hypers with excellent results. However, those with a history of back problems either should avoid the movement or, if they choose to do it, be careful and use a limited range of motion that gradually increases as they grow stronger.

ROMANIAN DEADLIFTS

How to correctly perform a Romanian deadlift:

1. Start this movement standing upright.
2. The barbell can be picked up off of a power rack; if that is not available, deadlift the weight conventionally off the floor.
3. Taking a stance between hip and shoulder width; place your hands right outside your thighs.
4. Use a pronated grip. (Straps are okay.)
5. Slightly bend your knees and keep your back arched and flat.

6. Lower the bar, keeping your chest up by pushing your hips back and purposely putting tension on the hamstrings.
7. Lower the bar to mid-shin level. (Your torso should be parallel to the floor.)
8. Lift the weight to the starting position by extending the hips.
9. Keep the bar in close to your body; the farther it drifts away from you, the more stress will be put on your lower back.

Important note: This movement can also be performed with dumbbells. If you want to try something different, try the single-leg version of this movement. Besides the typical unilateral benefits achieved, it will build balance. The single-leg version places greater stress on the hamstrings and can be done with dumbbells or a barbell. If you have a history of lower back problems, avoid this movement.

LEG CURLS

The hamstrings have two functions: flexion of the knee and extension of the knee. Romanian deadlifts work primarily hip extension, glute ham raises work both, and leg curls work knee flexion.

Hamstrings and their assisting role in hip extension are much more important to strength athletes than is knee flexion. Bodybuilders need to work the entire hamstrings. It is impossible to have great leg development or strength without good hamstrings.

How to correctly perform a leg curl:

1. Lie face down on the leg curl; adjust it to fit your body.
2. Put the pad of the lever slightly below your calves.

3. Keep your torso flat on the bench.
4. Grasp handles on the side of the machine.
5. Make sure your legs are fully stretched and curl your legs up as far as possible.
6. Hold briefly at the top.
7. Return to the starting position.

Important note: It is important to adhere to strict form when performing leg curls. The purpose of the movement is to isolate knee flexion and not to perform a pseudo-compound movement.

LEG EXTENSIONS

Leg extensions directly target the quadriceps. Walking, running, and everyday movements require muscles of the leg to work together. Leg extensions isolate the quadriceps, so this extension

is a very unnatural movement. Because of this, it operates on the overload principle of isolation. Having a well-developed "sweep" and "teardrop" is essential to your bodybuilding success.

How to correctly perform a leg extension:

1. Sit on a leg extension machine with your back against the padded support.
2. Place your shins under the padded lever.
3. Grab the handles for support.
4. Extend your knees until your legs are straight.
5. Hold at the top briefly.
6. Return to the original position.

Important note: This is an isolation movement, not an ego lift. Make sure you are getting a full range of motion. Because it is unnatural, using too much weight by cheating puts you at a high risk for injury. As with leg curls, this movement can be done unilaterally.

TOP TEN EXERCISES FOR CHEST

BENCH PRESS

This is the no-frills, blue-collar chest builder. Lifting maximum weights in the bench press is a favorite upper body limit-strength assessment and is the lift everyone in the Western world associates with weightlifting.

As mentioned in Unit 3, heavy bench presses are the go-to lift to develop massive pecs. The bench press allows you to lift more weight than any other free-weight exercise does.

Look at some of the best raw bench pressers of all time, such as Big Jim Williams, Bill Kazmaier, and Doug Young; they had some of the most muscular chests of all time, and these guys had way more muscle on their frame than did bodybuilders of the same era. Arnold was rumored to have consulted with Doug Young for mass building methods long before personal training was a recognized profession.

How to correctly perform a bench press:

1. Lie flat on a bench.
2. Un-rack the barbell at arms extension over your chest.
3. Grasp the bar with a pronated grip and slightly wider -than -shoulder- width grip.
4. Keep your upper back tight.

5. Make sure your feet are flat throughout the entire movement.
6. Grip the barbell tightly and lower the barbell under control to nipple line or slightly below.
7. Forcefully push the bar back to arms' extension.
8. Dismount barbell from rack over your chest.

Important note: This is a compound movement, and when you use the proper technique, more weight equals more growth.

The bench press is used primarily for chest development, but the shoulders and triceps will experience growth; many other synergist muscles contribute to heavy bench presses. As will be discussed in the next unit, bands and chains can both be used for bench presses. Generally, stick to 10%–25% of bar weight for the added accommodated resistance.

DECLINE BENCH PRESS

Dorian Yates is a big believer in the decline bench press. He says the pectoral muscles have two actions: flexion and adduction of your upper arm. Both of these happen during the upward phase of a decline bench press. There is no doubt that decline bench presses target muscle fiber of the lower chest, but they do actually hit the entire chest.

Many people are even able to lift more weight on a slight decline than on a bench press. The decline bench press should be performed on a 20- to 25-degree decline. Some people with shoulder issues report less pain with decline bench presses because it forces you to keep your elbows tucked in and removes some of the involvement of the shoulder joint.

How to correctly perform a decline bench press:

1. Lie on the decline bench press with your feet under the leg brace.
2. Lift the barbell from the rack with a slightly wider-than-shoulder-width grip.

3. Lower the weight to your chest.
4. Press the weight back to full extension.

WEIGHTED DIPS

These were a staple strength training movement before modern machines and gimmicks arose. Weighted dips have a place in a wide spectrum of programs that serve a vast range of goals. They build barrel chests and triceps that fill out shirt-sleeves. I have included them because weighted dips force you to handle your body weight plus an additional load.

As mentioned in Unit 3, many bodybuilders will refer to weighted dips as the "king" for the chest and the triceps. How many exercises claim this kind of monopoly on two distinct muscle groups?

Dips build strength in functional activities and in strength tests. Pat Casey, the first man to bench press 600 pounds, placed weighted dips at the core of his program.

Want to bench big? Try dips!

Besides, they offer great transference to overhead presses.

Bodybuilders with shoulder or elbow injuries may find dips to be a good substitute for bench pressing. Most importantly, dips have been the staple of many great physique athletes including Branch Warren, Johnnie Jackson, and Ronnie Coleman, to name just a few.

How to correctly perform a weighted dip:

1. Start dips with arms extended on the dip bar.
2. Lower your body until your arms are parallel to the floor.
3. Return to the starting point.

Important note: Unlike bench presses, dips are a closed-kinetic chain exercise, meaning you push your body through the air instead of using an external resistance object such as barbells, dumbbells, or a machine.

This is a more natural movement pattern.

Weighted dips with a forward lean were a favorite of late iron guru Vince Gironda. To shift more emphasis on the pecs, keep the elbows out, tucking the chin to the chest and leaning forward.

A more upright posture with elbows in will shift more of the emphasis to the triceps. Extra weight can be attached by way of adding plates or a dumbbell to a dipping belt, or if you are lucky enough to have a Nautilus dip machine at your gym, the Nautilus is much easier to use.

DUMBBELL INCLINE PRESS

For decades, inclines have been a favorite of bodybuilders to ensure hitting the upper portion (clavicular) of the chest. This movement can also be performed against band resistance by placing the band around your back. Barbell variations can also be used.

How to correctly perform a dumbbell incline press:

1. Sit down on the incline bench, resting the dumbbells on your thighs.
2. Kick the weights to your shoulders and lean back. (If the weight is extremely heavy, get a partner to help you.)
3. Position the dumbbells to the sides of your chest.
4. Press the dumbbells up until your arms are extended.
5. Lower the weight back to starting position.

Important note: This movement, as shown in EMG studies, also targets the deltoids. Triceps also play an important assisting role. For a fun variation, try the incline dumbbell or barbell press with a reverse grip.

FLOOR PRESS

The floor press has two basic variations. The barbell floor press and the dumbbell floor press perform with a neutral grip. It is important to mix in neutral grip pressing exercises with dumbbells because it hits the muscle at a different angle and it disperses a greater load across the triceps, which in turn prevents wear and tear of the shoulders.

How to correctly perform a floor press:

The floor press is essentially a bench press done while lying on the floor.

1. Set the barbell in supports on the power rack.
2. Un-rack it like a normal bench press.

3. Lower the weight until your triceps hit the floor.
4. Pause for a split second at the bottom.
5. Press the weight back up to starting position.

Important note: This exercise works extremely well with the addition of chains.

BENCH PRESS WITH WEIGHT RELEASERS

As we all know, you can handle more weight on an eccentric than on a concentric. To maximize muscularity, bodybuilders must include eccentrics in their training.

How to correctly perform a bench press with weight releaser:

1. Attach the weight releasers to the bar.
2. Lower the bar like in a normal bench press.
3. As the bar touches your chest, the weight releasers release; therefore, you push up only the bar weight.
4. Return to the starting position and repeat reps without weight releasers.

Important note: Anywhere from about 5%–30% of the bar weight can be used on the releasers. These can be done for a drawn-out eccentric or at a traditional tempo. If done without purposefully slowing the eccentric, the positive portion of the rep will potentially feel much more powerful because of the overload of the stretch shortening cycle.

DUMBBELL FLYES

This has been a favorite of bodybuilders and top raw bench pressers for decades and was in fact a staple in Arnold's regimen.

How to correctly perform dumbbell flyes:

1. Lie flat on a bench.
2. Lift the dumbbells above your chest with arms in a slightly bent position. (Your arms never straighten out throughout the entire movement.)

3. Lower dumbbells to the side until your chest muscles are stretched.
4. Bring the dumbbells together in a giant bear hugging-like motion.
5. Hold the dumbbells together at the top for a brief moment.
6. Return to starting position.

Important note: Remember, this movement is not a press or an extension. Think of it as giant hug. Once your elbows are bent 10–15 degrees, keep them in this fixed position. Concentrate on the squeeze.

This movement is extremely effective against resistance bands by putting the bands around your back and holding them in your hands. This not only makes it a great stretch exercise but also adds a peak-contraction element of constant tension throughout the entire movement. This can also be done on an incline or decline. If you have a history of shoulder problems, you will want to avoid this movement.

CHAIN FLYES

Chain flyes are a great substitute if you have shoulder pain or if you want to put less stress on your shoulders in general.

How to correctly perform chain flyes:

1. Attach a single handle attachment with a carabineer to a chain.
2. Perform the movement the same way as dumbbell flyes are done.

Important note: "I feel this in every muscle fiber in my chest!" screamed Johnnie Jackson after a difficult set of chain flyes. At the bottom of the movement, the chain unloads on the floor, so it

is not nearly as much weight in the more vulnerable position, but you still get a stretch. As you squeeze the weight up, link by link, the chain comes off the floor. As such, where the movement would be easiest, intensity increases.

SMITH MACHINE NEGATIVE OVERLOAD BENCH PRESS

Smith Machine negative overloads provide another way to eccentrically overload your pecs. This movement is performed with a Smith Machine and will require two partners.

How to correctly perform a Smith Machine negative overload bench press:

1. Lie flat on a bench placed under a Smith Machine. (The bar should be directly above your chest.)
2. Load the bar with 10%–25% extra weight on the outside of the bar sleeves.
3. Lower the weight to your chest.
4. At chest level, have a partner on each side pull the extra weight off the bar.
5. Forcefully press the weight back to starting position.

6. Then have the partners add the weight back to the bar.
7. Repeat for necessary reps.

Important note: This exercise works best drawing out eccentrics, so take five to six seconds to lower the bar and then forcefully press it back up. A good routine is to do that tempo for as many reps as possible. Once you can no longer complete a rep, pull the additional weight off, and do as many reps as possible at normal speed.

This is a highly advanced technique and should be used only with caution. As with other intense eccentric and accommodated resistance techniques, avoid them during deload weeks or recovery cycles.

DUMBBELL PULLOVERS

"You will not believe the ache in the sternum that this movement will produce! It literally forces your chest apart and forces it into new growth," said Arnold Schwarzenegger in regard to the dumbbell pullover.

The dumbbell pullover was a favorite of some of the greatest chests of all time such as Arnold Schwarzenegger, Reg Park, and virtually any old-timer. This exercise works not only the chest but also the lats and the intercostal serratus anterior (the muscles of the ribcage).

Maximally developed intercostal muscles will give the illusion of a bigger rib cage when you are taking a deep breath and holding a pose because the ribs are pulled up by the intercostal muscles. I believe one of the reasons chest development hasn't caught up with other body part development is because of the elimination of any pullover variations.

How to correctly perform a dumbbell pullover:

1. Lie perpendicular to the bench press, with only your shoulders supported.
2. Your feet should be flat on the floor, shoulder width apart.
3. Your head and neck should hang over the bench.
4. Your hips should ideally be at a slightly lower angle than your shoulders.
5. Place the dumbbell between your hands, which should be in a diamond shape, using your thumbs and pointer fingers. (Palms should be facing the ceiling.)

6. The movement starts with the dumbbell over your chest, elbows bent 10–15 degrees. (Maintain this angle throughout the entire movement.)
7. Slowly lower the weight backward over your head until the upper arms are in line with the torso.
8. The weight travels in an arc-like motion toward the floor.
9. Pull the dumbbell back over your chest, purposely squeezing the chest.
10. Hold for a second, and then repeat the exercise.

Important note: Those with a history of shoulder problems may need to avoid introducing this exercise.

TOP TEN EXERCISES FOR ARMS

JM PRESS

This huge triceps builder allows you to handle heavy weights. It is a hybrid of a close grip bench press and skull crusher.

How to correctly perform a JM press:

1. Lie face up on a bench press.
2. Grab the bar with a shoulder-width or slightly closer grip.
3. Un-rack the bar at arms extension.
4. Start the bar above your upper pecs with arms extended.

5. As you lower the bar toward your chest, allow your elbows to move slightly forward so they are forward from the wrist.
6. Stop about 5 inches off your chest, pause for a moment, and then push back to starting position.

Important note: With this movement, the bar is not moving straight up and down. Instead, it moves in an arc-like pattern. Make sure you keep your elbows close to your body during the exercise to maximize triceps activation.

DICKS PRESS

Legendary powerlifter Paul Dicks developed this triceps movement. It is a favorite among bodybuilders I train for slapping slabs of meat on the triceps.

How to correctly perform a Dicks press:

1. Lie face up on a bench press.
2. Grab the bar with a shoulder-width or slightly closer grip.
3. Un-rack the bar at arms extension.
4. Start the bar above your upper pecs with arms extended.
5. Lower the weight to approximately 1 inch above your chest.

6. Push your elbows up and shift the bar toward your chin.
7. While maintaining this position, press the weight back up to arms extension, leading with your fists.

CLOSE-GRIP BENCH PRESS

How to correctly perform a close-grip bench press:

1. Lie flat on a bench.
2. Un-rack the barbell at arms extension over your chest.
3. Grasp the bar with a pronated grip and at approximately shoulder width (about 3 inches closer than your regular grip).
4. Keep your upper back tight.
5. Make sure your feet are flat throughout the entire movement.

6. Grip the barbell tightly and lower the barbell under control to nipple line or slightly below.
7. Forcefully push the bar back to arms' extension.
8. Dismount the barbell from the rack over your chest.

Important note: During close-grip bench presses, try to keep your elbows in for maximized triceps activation. For a variation, you can place 2×4s on your chest, held by a partner. These are called board presses. The number of 2×4s on your chest would be the origin of the name of the exercise. For example, four 2×4s stacked on your chest would be a 4-board press.

Generally, to overload the triceps, three to five boards are used. This will allow you to use a much heavier weight. Also, if you want to further overload the triceps and remove stress from shoulders and pecs, you can use a slingshot device.

One close-grip burnout workout for your triceps is to complete five full-range-motion close-grip bench presses. Then, without racking the bar, have a partner immediately place 1 board on your chest. Perform 5 reps. Then, without racking, have a partner place two2 boards on your chest and complete 5 reps. Then, without racking, have a partner place 3 boards on your chest and complete 5 reps.

Do this again with four boards. By the end, you've done 25 repetitions. As you fatigue, leverage improves, providing a killer triceps workout. Close-grip bench presses and board presses can also be done with bands and chains.

ONE-ARM DUMBBELL TRICEPS EXTENSION

This is a basic triceps isolation movement. It does not matter how much weight you do. The goal is to provide maximum tension to the triceps through the overload principle of isolation. This can be done sitting or standing.

How to correctly perform a one-arm dumbbell triceps extension:

1. Position the dumbbell over your head or slightly back.
2. Lower the dumbbell behind your head while keeping the upper arms vertical.

3. Lower the dumbbell until your triceps are fully stretched.
4. All action should be at the elbow.
5. Return to starting position.

THE TRI-TRI SET

Joe Giandonato, MS introduced me to this exercise. Joe is a strength coach at one of the top high school sports programs in Pennsylvania and works with a number of college athletes in their off-seasons.

How to correctly perform a tri-tri set:

1. Grab a pair of dumbbells; Joe recommends 35% of the load you could use on dumbbell bench presses for 10 reps (e.g., if you could do 100s, use 35s).
2. Lie down on the bench.

3. Perform a neutral-grip dumbbell bench press.
4. From that top locked-out position, lower your dumbbells, hinging at the elbows, to the side of your head.
5. Extend back to the locked out position.
6. From the locked out position, lower the dumbbells behind your head.
7. Then extend at the elbow to the starting position. That is one rep.

Important note: The 35% load was for five reps. If you're doing more reps, obviously you may have to lighten the load a little bit.

CHEAT CURLS

This exercise has gotten some bad press. Arnold Schwarzenegger, Ronnie Coleman, and many other legends have had cheat curls as a major part of their biceps training regimen.

Cheat curls are not recklessly heaving a barbell. They are done to help you get through a sticking point. Generally, you will use anywhere from 10%–25% more weight than you would on a regular curl.

How to correctly perform cheat curls:

1. Keep your feet flat
2. Stand holding the barbell or EZ curl bar with hands shoulder width apart
3. Curl the weight up using your shoulders and hips to help get you past the sticking point
4. Hold at the top
5. Control the eccentric on the way down, taking two to five seconds to lower the weight

Important note: When done correctly, this movement provides a huge eccentric overload. If you are rising up on your toes, you're using too much weight.

INCLINE DUMBBELL CURLS

How to correctly perform incline dumbbell curls:

1. Lie back on a 45-degree bench.
2. Keep your palms supinated the entire time.
3. Your arms should hang straight down to the floor, fully extended.
4. Your arms are angled behind your body, so this requires a larger range of motion than a normal curl; it's a great stretch movement.

5. Keeping your arms stationary, curl both arms up toward your shoulders or as high as you can go.
6. Lower the weight to starting position and then repeat.

Important note: This movement is meant to

increase your range of motion. Do not shorten it. It is important to keep your palms supinated the entire time. This movement can also be done in an alternating fashion.

REVERSE FAT BAR CURLS

Because of the increased diameter of the bar, this movement really works the forearms hard. If you do not have a fat bar, you can order Fat Gripz from EliteFTS.com or simply wrap a towel around the bar.

How to correctly perform a reverse fat bar curl:

1. Perform this movement standing. Feet should be shoulder width apart. Arms should be straight when you start with an overhand grip.

2. While keeping your back straight, curl the weight up to the front of your chest.
3. Stop briefly at the top.
4. Lower the weight back to starting position.

Important note: You won't be able to lift as much weight this way. Don't worry if your poundages are down. Make sure you keep your elbows tucked in to your sides throughout the entire movement. For a fun variation, do this movement to failure and then follow this with traditional curls to failure.

ONE ARM ECCENTRIC BARBELL CURLS

How to correctly perform a one-arm eccentric barbell curl:

1. Sit or stand behind a preacher curl station.
2. Rest your upper arm on the pad in front of you, arms supinated
3. Start at the top position of the curl.
4. Slowly lower the bar for a count of 8 seconds to full extension
5. Pause briefly at the bottom.
6. Have your training partner help you back up or self-spot with the other hand.

Important note: Since your arm is supinated the entire time and you have to balance an Olympic sized barbell with one hand, your supinated muscles are forced to work overtime. Remember, the concentric portion of the lift is not what we are emphasizing.

ZOTTMAN CURLS

How to correctly perform a Zottman curl:

1. Hold dumbbells in each hand, palms facing forward.
2. Stand up straight with your elbows close to your torso.

3. Curl the weight up to your shoulders.
4. At the top, rotate your wrists with palms facing forward again.
5. Then lower the weight with a pronated grip.
6. At the bottom, rotate your wrists again with palms facing forward.
7. Repeat.

Important note: This exercise, on the negative phase, hits your forearms extremely hard.

TOP TEN EXERCISES FOR THE BACK

DEADLIFT

As mentioned in Unit 3, the deadlift is probably the oldest strength training movement in existence. Most strength training movements took some creative thinking to conceive. The deadlift is as basic as picking up a heavy object off the floor is. If we could only choose one movement to train with, it would come down to deadlift or squat.

For a long time, there was a great deal of anti-deadlift literature floating around that had absolutely no scientific basis. Thankfully, there has been a deadlift enlightenment lately, and this movement is getting the respect it deserves. Many bodybuilders today lack lower back development, but those who deadlift do not.

How to correctly perform a deadlift:

1. Face the bar with your feet approximately hip to shoulder width apart.
2. Bend your knees.
3. Grab the bar with an alternating grip, hands right outside your thighs.

4. In a half-squat position, with your back flat, keep the bar close to your body.
5. Lift the weight from the floor to a fully upright position.
6. Lower the weight to the floor.
7. Remember, the closer the bar is to your body, the lighter the weight is, and the safer the movement is.
8. Some reminders for proper deadlift technique:
9. Push through your heels.
10. The middle of the foot should be directly under the bar.
11. Shins should touch the bar.
12. The back is in extension; don't round it.
13. The shoulder blades should be directly over the bar, and shoulders will be slightly in front.

14. The elbows must remain in full extension throughout the entire movement.
15. Lower the bar in the opposite way the bar was lifted, in terms of hip and knee angles.

Important note: Biceps tears can occur with deadlifts on the underhand grip, so bodybuilders may want to consider doing deadlifts double-overhand grip with straps. This will prevent potential asymmetrical development and reduce the likelihood of injury.

BENT-OVER ROW

The bent-over row is one of the greatest ways to build upper back thickness.

How to correctly perform a bent-over row:

1. Stand behind the barbell with your deadlift stance.

2. Grab the bar with an overhand grip.
3. Lift the barbell off the floor to your stomach.
4. Your torso should be slightly above parallel throughout the entire movement.

Important note: You should keep your back flat and have a slight bend in your knees. For a variation, you can perform this movement with your torso at 45 degrees. This way, you could pick it up off a rack instead of the floor and will be able to use more weight.

PULL-UP/CHIN-UP VARIATIONS

Nothing builds a wide back like pull-up and chin-up variations do. These include narrow grips, wide grips, overhand, underhand, and neutral grip. I suggest making these variations a staple in your back-training routine.

Almost all bodybuilders with great back development have included some sort of "chinning" in their routine. If you are unable to do a pull-up/chin-up, instead of using a machine that assists you, opt for resistance bands. You just wrap the band around the bar at the top and put your knees through the other end.

Other exercises to help you get used to handling

your weight are negatives, for which you start in a chin-up position and purposefully lower yourself slowly. Another way to gain strength is to perform a flexed arm hang for as long as possible.

How to correctly perform a pull-up/chin-up:

1. Grab the bar with the grip of your choice.
2. Hang at arms extension.
3. Keep your chest up.
4. Lead the movement with your chest up and shoulders back.
5. Cross your feet behind you.
6. Look up as you pull yourself up.
7. Pull your chin over the bar.

8. Some heavily muscled bodybuilders will not be able to get their chins over the bar; in this case, just go as high as possible.
9. Lower yourself under control to the starting position.

Important note: You need to include pull-up/chin-up variations in your training. You should mix up what type you use. Not only will this exercise aid in building a broad, powerful-looking back, but also it will help you get stronger and improve shoulder health.

CHEST SUPPORTED T-BAR ROW ECCENTRIC OVERLOAD

This exercise has long been a favorite of many top bodybuilders to work their back. As this is an eccentric movement, muscle soreness following the training session in which this exercise is incorporated is not uncommon. Some individuals have reported feeling muscle soreness lasting up to a week after performing this movement.

How to correctly perform a chest supported T-bar row eccentric overload:

1. Load up the T-bar row machine with approximately 25% more than you usually use for 6–8 reps. (If you can use more weight, great.)
2. Your upper chest needs to be on top of the pad.
3. Lie face down on the pad and grab the handles.
4. Various grips may be used.
5. Have a partner help you lift the bar off the rack.

6. Extend your arms in front of you. (This will be where you start.)
7. Normally, this is the point where you pull the weight up by yourself, but now you will pull the weight up with the assistance of a partner.
8. From the top of the movement, lower the weight for 5–8 seconds to the starting point.
9. Make sure that, at the bottom of the movement, your arms are fully extended and you feel a deep stretch in your lats.

Important note: This is a very intense movement. Usually, when people do it for the first time, they will feel like their lats are automatically flared out for a few days and feel a severe, deep soreness in their lats. As long as they are performing the movement with maximum intensity and getting a full stretch at the bottom, they will experience extreme soreness.

T-BAR PRISON ROWS

This movement has been used by Arnold Schwarzenegger, Jay Cutler, Branch Warren, Johnnie Jackson, and Ronnie Coleman, to name a few. Many machines have tried to duplicate the prison row, but nothing seems to beat the bare-bones original.

How to correctly perform a T-bar prison row:

1. Load one side of the barbell with weight.
2. Place the opposing side in a corner space in the gym.
3. Place your feet shoulder width apart and stand over the bar right behind the plates.
4. Put a close grip handle under the bar and grab it with both hands.

5. Keep your back flat and arched and have a slight bend in your knees.
6. Pull the bar up toward your chest, squeezing at the top of the movement.
7. Lower the weight along the same path.
8. You should feel a good stretch in the lats at the bottom of the movement.

Important note: You should keep your elbows in close to your sides to place more emphasis on the lower lats. Some slight cheating is OK on this movement, but you don't want to be standing upright. This is one of those great exercises that have been passed on in bodybuilding one generation to the next.

STRAIGHT-ARM PULL-DOWN

In some pulling movements, the limiting factor is the biceps. Because the biceps are involved and they fatigue before the back does, one isolation movement that is great for back width is the straight-arm pull-down.

How to correctly perform a straight-arm pull-down:

1. Grab a straight bar or rope attachment on a pulling machine.
2. Step backward about 2 feet, facing the machine.
3. Fully extend your arms
4. Bend your torso slightly forward
5. Tighten your lats
6. Pull the bar down using your lats until your hands are down to your thighs.
7. Make sure you keep this movement strict; if you start to cheat, it becomes ineffective.
8. Return to starting position, always staying under control

RACK PULLS

Rack pulls are a partial deadlift. They can be used as an overload because you can handle more weight than you can on a full range of motion deadlift. They work extremely well for developing a thick back.

How to correctly perform rack pulls:

1. Place a barbell in a squat rack.
2. Stand in the squat rack using a normal dead-lift stance.
3. The bar can be anywhere from 2 inches above the knee to 2 inches below the knee.
4. Bend your knees slightly.
5. With your arms fully extended, grab the bar with your deadlift grip.
6. Extend your hips and lock the weight out.
7. Lower the bar back to the starting point.

Important note: Rack pulls not only develop your back but also target your hamstrings and glutes very effectively. Some bodybuilders with lower back problems who have trouble doing regular deadlifts might still be able to perform heavy rack pulls.

ONE-ARMED DUMBBELL ROWS

How to correctly perform a one-armed dumbbell row:

1. These can be done standing with your hand placed on a rack at approximately waist height.
2. If you're doing your right side, your left hand would be on the rack.

3. Place your left foot forward and your right foot back with a staggered stance.
4. Keep your back close to parallel to the floor.
5. Grab the dumbbell with your right hand and drive your elbow up toward the ceiling, keeping the dumbbell at your side with a neutral grip.
6. Concentrate on pulling the dumbbell up using your back rather than your biceps. (In the long run, you'll do more weight this way and get the desired result.)
7. Pull the weight up forcefully, but keep control of the dumbbell during the negative portion of the lift.
8. At the bottom of the movement, not only return to full arm extension but also go beyond this and actually feel the stretch in your lat.

Important note: You can do this movement heavy. You're not doing it for your grip, so don't be afraid to throw on straps. If you have a bad lower back, an alternative is to put one arm and the corresponding knee on a bench. This will release pressure from your lower back.

Johnnie Jackson, who had the best back in the 2012 Mr. Olympia contest, did a 250-pound dumbbell for reps consecutively for 30 seconds on both his right and left side. I recommend starting this movement with your weaker side.

LAT PULL-DOWNS ON YOUR KNEES

A great lat isolation exercise is the lat pull-down. One variation that sticks out is performed on the knees with a cable in each hand. The advantage is that both limbs operate independently of one another.

How to correctly perform lat pull-downs on your knees:

1. Get on your knees in the center of a cable station.
2. Grab each handle, making sure your arms are at full extension and you feel a good stretch in your lats.

3. Pull the weights down to your side.
4. Squeeze your lats together at the bottom.
5. Hold this position for a half second (0.5 second).
6. Return to the starting position.

Important note: This exercise needs to be performed very strictly.

SEATED CABLE ROWS

For decades, bodybuilders and strength athletes have used seated cable rows for overall back development.

How to correctly perform a seated cable row:

1. Using a low-row neutral grip attachment (looks a V or U), grasp the handle with both hands.

2. Keeping your elbows in, pull the weight to your stomach.
3. As the weight touches your stomach, keep your chest up and squeeze your upper back together.
4. Your legs can be slightly bent.
5. After a brief hold, return to the starting position with your arms in full extension, feeling a mild stretch in your lats.

Important note: A fun variation to this exercise is the eccentric overload version. You begin this exercise the same way, pulling it to your stomach and squeezing your back, but as you release the weight, you will let go with one hand and lower the weight with one arm. You can obviously handle much more weight on the eccentric. Eccentric overloads are vital for bodybuilders to induce satellite cell proliferation, which will help maximize muscle growth.

TOP TEN EXERCISES FOR SHOULDERS

DUMBBELL MILITARY PRESSES

The standing military press was an Olympic lift until 1972. Not only does this version work the entire shoulder, unlike most pressing variations, but also it is huge for building core stabilization.

Core lifts are the foundation of a solid bodybuilding program. Doing seated dumbbell military presses allows you to focus on pressing the weight, rather than on balancing, because of the support of the pad. Furthermore, dumbbells allow you a better stretch at the bottom of the movement.

Many bodybuilders opt for seated military presses with a barbell over the dumbbell variation. This is fine, but one potential error I see made too frequently is that the lifter is not completely

seated against the pad. The torso is closer to a 45-degree angle than a 90-degree angle, turning the lift into more of an incline press.

How to correctly perform a dumbbell military press:

1. Position the dumbbells to each side of your shoulders; if they are heavy, you can get a partner to help you.
2. From this position, push the dumbbells upward until the arms are extended overhead.
3. A pronated or neutral grip can be used.
4. From the extended position, control the negative and lower to the starting position.
5. Repeat.

Important note: For a variation of this exercise, instead of locking the weights all the way out at the top, try ¾ reps to further overload the deltoids and take some of the triceps involvement out of the movement.

Another fun variation, one that will increase time under tension, is to perform the press by holding the off arm in extension while performing the exercise with the other arm in an alternate fashion.

ARNOLD PRESSES

The Arnold Press is a great shoulder exercise. I'll bet that you can't figure out who it's named after.

How to correctly perform an Arnold press:

1. This can be performed standing or seated.
2. Stand with two dumbbells positioned in front of your shoulders with your palms facing your body and your elbows under your wrists.
3. From this position, rotate your shoulders out to the sides.

and then to full extension, rotating your palms facing outward.

5. Lower in the opposite pattern with a controlled negative.

Important note: This is a compound pressing exercise. However, because of the shoulder rotation outward (abduction), special emphasis is placed on the middle deltoid.

UPRIGHT ROWS

The upright row is a compound movement. It primarily works the upper traps and the deltoids. Many smaller muscles are also used.

How to correctly perform an upright row:

1. Stand with your feet shoulder width apart.
2. Grasp a barbell with a narrow grip, with palms facing your body

3. Pull your shoulders back, lift up your chest, and arch your lower back.
4. Initiate the movement with your elbows and pull the bar up toward your chin.
5. Your elbows should remain above the bar the entire time.
6. Keep this movement strict.

Important note: If you have a history of shoulder problems, avoid this movement. Full range of motion is advised; however, limit that range of motion as soon as you start feeling any pain or discomfort.

BARBELL SHRUGS

We are choosing to include shrugs with the shoulder work, but they could have been included with back work. Large traps exemplify an intimidating, masculine physique. Some bodybuilders do need to be careful because overly developed traps can make the shoulders appear narrower. Shrugs are the bread-and-butter trap exercise.

How to correctly perform a barbell shrug:

1. Stand in front of a barbell and pick it up off the rack, with your feet hip width apart and your hands approximately shoulder width apart.

2. Grab the bar with an overhand grip.
3. Use straps.
4. With your arms remaining in full extension throughout the entire movement, elevate your shoulders as high as possible.
5. Lower the weight and repeat.

Important note: These can be done explosively or by holding at the top. Explosive shrugs will transfer better to strength lifts and build more overall size. Shrugs done with the peak contraction style are more of an isolation movement.

Repetitively doing heavy shrugs can potentially lead to poor posture because of the heavy weight with the bar in front of you. Therefore, cycle in shrugs with dumbbells as well. These are performed the same way except the dumbbells are held to the side of your body. This can also be done with a trap bar, if you have access to one.

HALF-HALF FULL DUMBBELL PRESSES

This could have been included as a variation of the traditional dumbbell press, but it is simply too effective not to get its own special place.

When performing this movement, focus on controlling the negative and exploding on the positive. This really stresses the deltoids and greatly increases time under tension.

How to correctly perform the half-half full dumbbell press:

1. Start while seated on a seated military bench.
2. Rest the dumbbells on your shoulders.

3. Push the weight halfway up.
4. Return to the starting position.
5. Push the weight halfway up again.
6. Return to the starting position.
7. Now push the weight all the way up.
8. Return to starting position.

Important note: This could also be completed with a barbell.

CABLE LATERAL RAISES

The cable lateral raise is one of the best ways to directly stress the medial head of the deltoid. That part of the deltoid gives you that capped, superhero-type look. Remember, this is an isolation movement. Focus on form, not weight.

How to correctly perform the cable lateral raise:

1. Set the pulleys of a cable machine to the low setting and select the appropriate weight.
2. Stand facing away from the machine.
3. Grab the left handle with your right hand (across your body).
4. Keep your elbows high throughout the entire movement.
5. Keep your arm almost straight, just a few degrees shy of extension
6. Abduct your right arm across your body to the right side.
7. Once you get to shoulder height, pause briefly and then lower the weight back to starting position.

Important note: Lateral raises are one of the most effective medial delt builders. Lateral raises are also one of the most abused exercises. Do a YouTube search, and you will see countless videos of bodybuilders recklessly heaving up dumbbells using more momentum than muscle.

The advantage to the cable is the constant tension placed on the muscle making you need to put out maximal effort throughout the entire movement. For a variation, give seated dumbbell lateral raises a try. Remember: form first.

FACE PULLS

Face pulls work the posterior deltoid and, surprisingly to most, even put extreme stress on the medial deltoid, according to EMG studies Bret Contreras performed. Face pulls also target your back's weak scapular muscles, which help stabilize your shoulder joints. This is great for shoulder health. Additionally, this movement strengthens your lower traps.

How to correctly perform a face pull:

1. Attach a rope to a high pulley station.

2. Grab the end with each hand, with your palms facing each other.
3. Back away from the machine until your arms are at extension.
4. Pull the rope toward your eyes.
5. Your hands should end up just outside your ears.
6. Hold for one second and return to the starting position with your arms in full extension.

Important note: Keep this exercise strict. It is not an ego exercise.

BENT-OVER LATERAL RAISES

Bent-over lateral raises are an isolation exercise for the posterior deltoid. If you want boulders for shoulders, you have to build the back part of the shoulder.

How to correctly perform a bent-over lateral raise:

1. Lean forward at the waist with your torso at approximately 45 degrees.
2. Maintain a strict arch, keeping your back straight.
3. Feet should be shoulder width apart with a slight bend in the knees.
4. Dumbbells are facing each other.
5. With a slight bend in the elbow, raise your arms to your sides. (Your elbow position does not change.)
6. Briefly pause at the top, squeezing your shoulder blades together.
7. Return to starting position.

Important note: Keep this movement strict. One variation you can do is to make the movement head supported, putting your forehead on the back of an incline bench to make sure your torso position doesn't change.

BAND PULL APARTS

Poor shoulder health is a problem that plagues the bodybuilding community. Band pull aparts work the rear deltoids, middle back, and traps. These aren't the best muscle builder of all time, but they certainly help maintain optimal shoulder health. That's why exercises such as this and the face pull have been included.

How to correctly perform a band pull apart:

1. Begin with your arms extended straight out in front of you at chest level.
2. With a resistance band, which can be purchased from EliteFTS, pull the band apart in a reverse flye motion.

3. Keep your arms straight.
4. Pull the band apart until your arms are at your sides.
5. Hold this position for a split second.
6. Return to the starting position.

Important note: This is a strict exercise that should be performed for higher reps. The narrower you place your hands at the start of the movement, the more difficult the exercise is because it increases band tension.

HANDSTAND PUSH-UPS

In 1992, California banned weights from prisons, and much of the nation followed suit. If you take a stroll on the prison tier, it is amazing to look at the shoulder development of inmates with no access to weights.

One reason is the handstand push-up, a popular exercise among inmates for decades. This was one of Mike Tyson's favorite exercises to develop large, powerful deltoids.

How to correctly perform a handstand push-up:

1. With your back to the wall, bend at the waist and place both your hands on the floor with a shoulder width or slightly wider stance.
2. Kick your feet on the wall with your arms straight and walk your body flat against the wall.
3. Your arms and legs should be fully extended.
4. From this position, slowly lower yourself to the ground and almost touch your head to the floor.
5. Push yourself back up to the starting position.

Important note: This is a very advance movement, and should only be performed clients who demonstrate adequate strength and have significant resistance training experience.

EXERCISES FOR ABS, CALVES, AND NECK

By performing the aforementioned exercises, you are already working your abs, calves, and neck indirectly.

Here are some helpful exercises that can assist you in reaching your goals:

- Leg raises
- Planks
- Side planks
- Landmines
- Standing cable crunches
- Standing calf raises
- Seated calf raises
- Calf raises on the leg press
- Four-way neck machine
- Neck harness

A FEW LAST WORDS

You have now been given the knowledge on how to select training exercises. Do not fall into the trap of tradition. Be the shining light on the city on the hill in the bodybuilding world by using sound science as your guide, and you will build the physique of your dreams.

TOPICS COVERED IN THIS UNIT

Bands for Powerlifting

Using Bands and Chains

- Setting Up Bands
- Setting Up Reverse Bands
- Setting Up Chains

Crucial Points about Bands and Chains

Bands and Chains Improve Strength Curve

Bands and Chains for More than Core Movements

Stretch Movements

Contracted Exercises

- Dumbbell Band Resisted Flyes
- Chain Flyes

A Few Last Words

UNIT 5

BANDS AND CHAINS BREAK INTO BODYBUILDING

Bands and chains for bodybuilding?

You can't be serious. Or can you?

You just might be surprised to learn how far back they go with the sport.

Back in the early 1900s, Eugene Sandow, the founding father of bodybuilding, was selling a home exercise device that used rubber resistance bands for strength training. Decades later, elastic bands could be purchased in the 1970s and were marketed as a cheap, safe, and effective method for duplicating isokinetic resistance machines.

Yuri Verkhoshansky wrote about elastic bands in his 1977 book, *Fundamentals of Special Strength-Training in Sport,* a truly classic masterpiece from the fabled Soviet Bloc.

By the late 1980s and early 1990s, powerlifting Guru Louie Simmons was writing about adding bands and chains to barbells. However, before Simmons came onto the scene, ISSA cofounder and world-renowned strength coach, Dr. Fred Hatfield, was using bands with elite athletes in the early 1980s.

Prior to this, Hatfield's business partner and ISSA president, Dr. Sal Arria, had marketed a band system in the 1970s. Some evidence from Weider's publications suggests Americans learned about bands from the Soviets in the 1970s.

BANDS FOR POWERLIFTING

Elite-level bodybuilders and powerlifters find materials that work, and then the ivory tower determines why they work later. Such is the case with providing accommodating resistance by adding bands and chains to barbells.

Elite-level powerlifters have used these tools to help push the limit of superhuman strength. Since 2000, the use of accommodating resistance tools have become more popular in mainstream strength and conditioning circles. As such, it is no surprise that a number of powerlifting world records have been broken post 2000.

Accommodating resistance tools can provide substantial overload to athletes, enhance rate of force development, allow athletes to work around injuries, deliberately attack sticking points, and effectively complement a human strength curve. We must let science be our guide. Because of these benefits, a vast majority of universities and mainstream strength and conditioning facilities now have bands and chains.

Bands and chains have started popping up in gyms around the globe, similar to the way Spandex did in the 1980s. The difference is, unlike Spandex, bands and chains can *actually help* your workout.

One study presented at the 2004 National Strength and Conditioning Association Convention demonstrated that athletes who did band-resisted bench presses had a significantly greater increase in their bench press max, along with power produced, compared with athletes who trained only with straight bar weight.

Another breakthrough study performed by the University of Wisconsin–La Crosse found that athletes had 25% more leg power than when compared with performing traditional free weight squats without the addition of accommodated resistance.

Hey, wait. This is all great, but isn't this course about bodybuilding? Yes, it is! However, we must remember our limit strength is our base.

A study was performed by Ithaca College (Ithaca, New York) in which researchers directly confirmed the anabolic effects via the implementation of band training. The study demonstrated that athletes combining bands with bench presses and squats had strength gains that were more than

double those of their counterparts who only used free weights without additional bands: the band group doubled the amount of muscle gained! That directly applies to you as a bodybuilder.

USING BANDS AND CHAINS

Let's take the squat as an example.

As the lifter squats the weight down and then back up to an erect starting position, the resistance (from bands/chains) decreases on the way down and increases on the way up; by how much depends on the strength of the bands or the weight of the chains.

As you get toward the completion of the lift, more force will be required to complete the lift; in turn, more muscle fibers are required to complete the lift. Therefore, the benefits to the bodybuilder are apparent: As the range of motion lengthens, resistance becomes more powerful. In turn, you are forced to recruit more muscle fibers, which translates into more growth. And of course you become stronger.

Chains feel much more like a barbell using straight weight than bands do. Chains perform nearly like the missing link between band-resisted movements and movements that use traditional iron.

Again using the squat as our example, chains are draped from the end of a barbell so, as you descend to the floor, the chain will subsequently unload link by link onto the floor. This means that as you descend into the bottom position, resistance is the least where you are the weakest, not to mention that you are more likely to achieve full depth because of the lightened load. As you lift the weight back up on the ascent, the resistance increases as each link is lifted off the floor. You can quarter squat more than you can full squat, as your leverage improves in the quarter squat position. And during the completion, you will be lifting increasing amounts of weight where you can handle it.

Bands work similarly to how chains do: As leverage improves, resistance increases. But in the squat, bands don't just hang off the bar onto the ground; they are actually attached to the floor via a dumbbell, a specialized attachment, or even the bottom of a rack. As the two ends of the band move closer together on the descent of a squat, the resistance decreases. As you squat the weight back up and the bands pull farther apart, resistance increases. However, bands do cause an over-speed effect on the eccentric portion of the movement; so remember this: Performing more than eight reps or using them too frequently puts you at a greater risk of overtraining.

Here are some tips on setting up bands/chains for common movements:

SETTING UP BANDS

The way you set up bands depends on the equipment at your disposal and what exercise you are training.

If you are squatting in a power rack, you have a couple of options: Set the safety pins at a low position and loop the bands around them and attach them to the barbell. Alternatively, loop the bands around the bottom of the safety rack. Some higher-end racks even have a special peg attachment for bands.

If you are in freestanding jacks and have to use dumbbells, make sure you place a barrier such as plates around them so they do not roll when you walk the weight out. The bench press may also need to be performed in a power rack with the bands set up as suggested for the squat, or you can loop the bands around very heavy dumbbells. Regardless of what setup you use, make sure the bands are set evenly.

My favorite technique for bench press entails attaching only one band to each end and sliding it under the bench. For deadlifts, Jump Stretch actually makes a platform specifically for deadlifts; this is an excellent investment. Other options are to use one band and to step on the band to make sure it stays in place; this is becoming more common.

SETTING UP REVERSE BANDS

Bands need not be applied only to a barbell in a bottom-up fashion. They can also come from the top down. This method, if using the bands in a reverse fashion, is in fact known as the *lightened method*.

For the squat, attach the bands to the top of the squat rack instead of the bottom. The farther you squat down, the more the band helps you; so as you are in the deepest, most difficult position, the band will help you the most, and as you squat the weight back to the starting position, the band will help you less and less. This is the same accommodating resistance concept but in reverse order.

Just think: If you have strong quads, odds are that your quads are not getting a huge overload as you complete a squat; if your chest and anterior deltoids overpower your triceps, it will be very difficult to sufficiently overload your triceps with a compound movement such as a close-grip bench press.

Whether it's with chain resistance or reverse bands, you will now be able to effectively overload your triceps with a compound movement because of the additional resistance. As you lock the weight out, your triceps are the prime mover. At this point in the movement, they will be overloaded.

In a way, bands and chains can provide the benefit of a compound movement, but at the same time, overload individual muscles in compliance with the principle of isolation. This is exciting, groundbreaking news for bodybuilders—don't get left behind.

SETTING UP CHAINS

Setting up chains is much easier than setting up bands is. Double A Weightlifting Systems has made a device specifically for setting up chains. It's extremely helpful and has made my job training athletes much easier.

For the squat/bench, to attach the chains to the bar, most lifters use a smaller chain. The smaller chain allows you to form a loop and fasten the loop with a carabineer. You will attach the larger chain/chains to the loop. For the deadlift, if you do not have the Double A Weightlifting Systems device, simply drape the chain over the barbell sleeve.

CRUCIAL POINTS ABOUT BANDS AND CHAINS

- Bands cause an over-speed/more powerful eccentric part of the movement than chains do
- Chains feel much more like straight weight than bands
- It's easier to overtrain on bands than on chains
- It is easier to overtrain with bands and chains than with traditional resistance
- Avoid sets of more than 8 reps with bands
- Unlike chains, bands allow non-linear resistance (i.e., they can be attached to a pec deck or diagonal leg press and still work like they do with a linear barbell movement)
- Neither bands nor chains should be used more than three weeks in a row because of potential overtraining

BANDS AND CHAINS IMPROVE STRENGTH CURVE

As an ISSA Certified Fitness Trainer, you know that a strength curve is a visual representation (graph) of how much force one can produce over a full range of motion on a specific movement. Dr. Fred Hatfield has extensively studied and expanded upon the strength curve. He has shown that a strength curve has seven distinct features that can be improved upon with the addition of bands and chains.

Angle Q: The Angle Q involves starting strength (being able to turn on as many fibers as possible at once, instantaneously).

1. **Angle Q (starting strength).** The Angle Q involves starting strength (being able to turn on as many fibers as possible at once, instantaneously). Think about throwing a punch as fast as possible or lifting a weight from a dead position in a rack, like a dead bench press. Although acceleration can be "gradual," starting strength is not—it happens all at once. Compensatory Acceleration Training, plyometric training, or various Olympic lifts (assuming the athlete has proficient technique) could be used to enhance starting strength. Thus with bands and chains, if you do not start the weight with sufficient force, you will not be able to complete the repetition; every inch the bar moves, resistance increases, so poor starting strength is not an option with the addition of bands and chains.

Subangles of A (Acceleration): Acceleration is best achieved by improving explosive strength (your ability to turn on as many muscle fibers as possible and leave them on). In the strength curve, the angles of A should become greater and greater (positive acceleration).

2. **Subangles of A (acceleration).** Acceleration is best achieved by improving explosive strength (your ability to turn on as many muscle fibers as possible and leave them on). In the strength curve, the Angles of A should become greater and greater (positive acceleration). It comes down to one thing: To improve acceleration, you must compensatorily accelerate while you train! This means to lift the submaximal weight with maximal force. It should be noted that compensatory acceleration training (CAT) does have a big drawback: the negative acceleration phase, which is the deceleration of the bar over the final portion of the lift. Studies have shown that the bar can start to decelerate up to 50% of the range of motion during CAT training. If you pull a deadlift as fast as possible, the final 50% of the lift may be decelerated because of your body's built-in safety mechanism. That's where bands and chains come into play. As an elastic band stretches off ground, resistance increases, so you have to keep pulling with maximum force and acceleration. The same thing applies with chains: As each link comes off the bar, resistance increases. Bands and chains can essentially circumvent the negative acceleration phase of compensatory acceleration training. They also force you to use more muscle fibers; cruise control is not an option as leverage improves.

Limit Strength - Limit strength is how much musculoskeletal force you can generate for one all-out effort.

3. **Limit strength (your absolute limit of strength).** Limit strength is how much musculoskeletal force you can generate for one all-out effort. The only athlete who displays limit strength in competition is the powerlifter. This is your base as a bodybuilder! All athletes

do need a certain level of limit strength, and therefore it should be the first objective on your list in altering the strength curve. Bands and chains are very beneficial for enhancing limit strength, as countless studies now show. Think about it logically: Can you half squat or full squat more? Of course you can half squat more. A full squat will provide sufficient overload on the bottom portion of the lift but certainly not on the top half. How can we overcome this? Simple: by adding bands or chains; as leverage improves, resistance increases, so more force (rather than a deceleration) is required to complete the lift. Furthermore, this continuous tension provided is similar to what a cable does, yet you retain the benefit of the free weight movement, unlike with the cable.

4. **Amortization (the brief period between the eccentric and concentric contraction)**. The amortization phase is that brief moment between the eccentric and concentric contraction. When you are squatting, this is the brief period between descent and ascent. Bands particularly cause an over-speed effect on the eccentric phase of a movement: A fast movement produces a fast countermovement. Because of this, the efficiency of the amortization phase is enhanced.

Amortization: The amortization phase is that brief moment between the eccentric and concentric contraction.

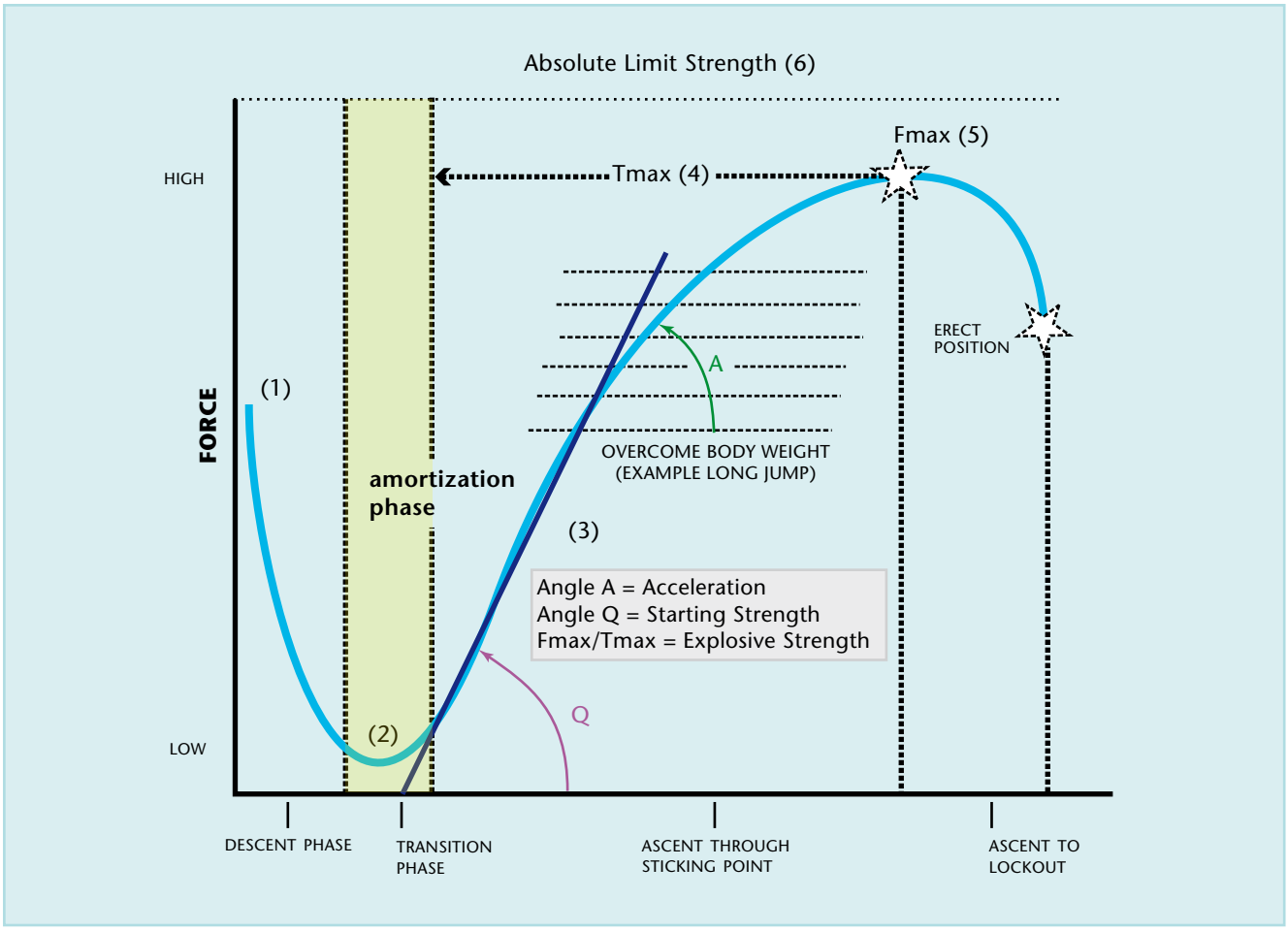


Figure 5.1 Strength curve.

F-Max: Maximum amount of force produced.

5. **F-max (maximum amount of force produced).** Because of the negative acceleration phase with CAT training with straight barbell weight, ultimately the amount of force you produce in your strongest portion of the lift (think the top half of the squat after you come out of the hole) is compromised. This is your body's built-in safety mechanism. Bands and chains are a game changer; you have to continually produce more force to keep the weight moving concentrically because the bands/chains are continuing to increase in resistance.

T-Max: The time it takes to reach F-max.

6. **T-max (the time it takes to reach F-max).** As a barbell with a band or chain is lifted, additional resistance is rapidly applied. Because of additional resistance and the effect of the over-speed eccentric, the time allotted to reach maximum-force output is reduced. Soviet sports scientists were most interested in this particular relationship.

F/T: The relationship between F-max and T-max, or "power."

7. **F/T (the relationship between F-max and T-max, or "power").** Because more force can be produced with additional band and chain resistance with a faster rate of force development (RFD), bands greatly enhance power production; studies confirm this.

Science, along with obvious anecdotal evidence from the trenches, confirms the effectiveness of bands and chains for becoming more powerful. Let's look at how this directly benefits you, the bodybuilder, by comparing a full range of motion deadlift to a quarter-rack pull (a quarter top-end range-of-motion deadlift). You can obviously handle much more weight for a quarter rep than for a full rep. By adding bands or chains to the bar, as you lift the weight toward lockout, every inch of the way has additional resistance applied to the barbell. This means that the rep will be challenging throughout the entire range of motion. Essentially, it is like a synergistic hybrid-blend exercise because you are getting the benefit of a full range of motion exercise and essentially the benefits of an overload partial movement. Because of maximal overload throughout the entire movement, proper implementation will result in maximum muscle growth. Proper periodization, as discussed later in the text, is paramount to success because an exercise with additional band or chain resistance makes the exercise much higher intensity than when the movement is performed in the traditional sense. Because of greater tension throughout the entirety of the movement, at no point can you go into cruise control mode.

Bands and chains can help injured lifters perform core movements through a full range of motion in some instances in which they may not otherwise be able to perform.

Shoulder injuries are common among iron game veterans who have performed heavy pressing movements year in, year out. Use the bench press as an example. Many of these lifters experience pain on the

bottom portion of lift. Thus, in the past, they have generally had the option of dropping the movement altogether or performing partials.

Once again, bands and chains are a game changer because the weight will be much less at the bottom portion of the lift (where it needs to be), and resistance will increase as the weight approaches the top end of the lift. This will help produce sufficient overload along with letting this lifter continue to train injury free. The same can be said of deadlifts. Many lifters with lower back problems are able to perform deadlifts because of the lighter load off the bottom.

BANDS AND CHAINS FOR MORE THAN CORE MOVEMENTS

If you haven't done so already, I highly recommend that you read Steve Holman's *Train Eat, Grow: The Positions-of-Flexion-Muscle-Training Manual*. Holman does an excellent job of describing three different kinds of movements.

The first type of movement discussed (referred to as **mid-range movements**) is compound movements. These movements target a large number of muscles and force them to work together to lift the weight. Synergists assist in lifting the weight.

Mid-range Movements: These movements target a large number of muscles and force them to work together to lift the weight. Synergists assist in lifting the weight.

A practical example would be the bench press. The target muscle is the chest, but the deltoids and the triceps play significant assisting roles. Because of this, the heaviest weights can be used, thus providing a maximal overload. These exercises provide the best bang for your buck; when building your base and bulking up, it is paramount to concentrate a majority of your efforts here.

Examples of these types of movements include:

- Quads: Front Squats
- Back: Deadlift
- Shoulders: Overhead Press
- Chest: Bench Press
- Triceps: JM Presses
- Biceps: Barbell Curls
- Hamstrings: Romanian Deadlifts

Anyone who has spent any time around a hardcore gym or serious training facility has seen people use bands and chains on core movements such as squats, bench presses, and deadlifts.

As discussed earlier, these devices can be advantageous to you, the bodybuilder. Generally, for raw powerlifters, I recommend using 10%–25% additional band or chain resistance for core movements.

Many times you will hear about powerlifters literally using more accommodated resistance than weight on the bar. The issue here (and what you don't read in the fine print) is that these lifters literally double the amount of weight they can legitimately lift without supportive equipment.

The first man to "bench press" 1,000 pounds in competition with supportive gear could reportedly bench press 550 raw without his super suit. Another lifter dropped from a more than 1,200-pound squat in gear to 600 pounds raw in competition.

As bodybuilders, we are trying to work the muscle, not to manipulate equipment and leverage for a competitive situation or to satisfy the ego.

Generally, bodybuilders will do well within these recommendations for raw powerlifters; after all, that is your foundation. Of course, if you are going for a specific overload effect, you might go outside these guidelines. Just keep in mind that, with an excessive amount of band tension and the over-speed effects it causes on the eccentric portion of the movement, you will be sore and will take longer to recover.

The same holds true with doing very high reps with band resistance. A general recommendation is to do fewer than eight reps; if you exceed this number, you will have more success with chains.

Stretch Movements: These movements put a muscle at a position of maximal elongation. The idea is to activate the stretch reflex so you can recruit muscle fibers that may not have been directly hit with the compound movement.

STRETCH MOVEMENTS

These movements put a muscle at a position of maximal elongation. The idea is to activate the stretch reflex so you can recruit muscle fibers that may not have been directly hit with the compound movement.

Stretch position movements are theorized to produce a very favorable IGF1 response, an extremely anabolic hormone. Although hyperplasia has not been proven in humans, many believe that stretch movements would have the best chance of inducing it.

Some examples are:

- Biceps: Incline Dumbbell Curls (palms supinated the whole time)
- Triceps: French Press
- Hamstrings: Stiff Leg Deadlifts (also a compound movement)
- Chest: Dumbbell Flyes

Contracted Exercises: Exercises in which constant tension is placed on the muscle throughout the movement.

CONTRACTED EXERCISES

I like to call these peak contraction exercises because constant tension is placed on the muscle throughout the movement.

A great example of this type of movement is the idea of a cable or accommodated resistance in general. In essence, as leverage improves, resistance increases; so the muscles have to contract maximally throughout the entire movement, not just in optimal leverage positions.

Usually, when bodybuilders talk about feeling reps, squeezing reps, and shaping reps, they are referring to peak contraction style movements. The whole idea is to feel the muscle—not ballistically perform the movement.

Here are some examples:

- Triceps: Triceps Push-downs
- Biceps: Cable Concentration Curls
- Chest: Cable Flyes
- Lats: Stiff-Arm Pull-downs

You have to hit muscles from different angles to maximize your physique. Doing so will require compound movements, exercises performed in a stretched position and, of course, peak contraction ones.

Exercises that have classically fallen into one of these categories with the addition of bands and chains can cross over and suddenly fit into two of these categories. This makes the sum greater than the individual parts, producing a wonderful synergy, and you will have an advantage over your competitors.

Here are some practical examples for the chest.

DUMBBELL BAND RESISTED FLYES

You will put a resistance band around your back, holding it in your hands. You will also place a dumbbell in each hand while the resistance band is still across your hand. You still receive the

maximal stretch the solid, dead pig iron provides, but as you squeeze the dumbbells together, you now get a peak contraction-like effect. Dumbbells give a maximum stretch, solidly hitting the outer pecs. But as you squeeze them together, you essentially go onto cruise control, getting robbed of a true peak contraction. Bands change this—you now get that. Go ahead and give this synergistic chest builder a try.

CHAIN FLYES

Flyes are undoubtedly a great chest exercise. However, they may fall on the risk side of the risk-to-benefit ratio for bodybuilders with shoulder problems because of the excessive strain caused by the stretch position.

Many bodybuilders in the situation will opt to train only with cables or mainly a pec deck. Chain flyes change that. Chain flyes are

performed by attaching the same handles you use to perform cable crossovers to chains. You still obtain some of the stretch you feel with dumbbells that is lost with cables, but it is extremely moderate in comparison. As your arms abduct to the fully stretched position, the chains unload on the floor, removing much of the strain from the shoulders. As you adduct or squeeze your arms back together, the chains start to lift off the floor again, giving you the peak-contraction advantage of the cables.

A FEW LAST WORDS

There are plenty of other movements where bands and chains can be used, whether it is a band-resisted bar dip or doing drop-set pull-ups with multiple chains; as you fail, pull off chains and keep going. It might be chains on a barbell curl, bands on a leg press, or a close grip bench press with chains. There are endless possibilities.

To be the best, you are going to have to change with the times, and the new frontier of bands and chains is here. Use them for great results.

TOPICS COVERED IN THIS UNIT

Interval Conditioning

- Barbell Complexes
- Zen and the Art of Variable Manipulation
- Strongman Training
- Kettlebell Interval Training
- Jumping Rope

A Few Last Words

UNIT 6

AEROBIC TRAINING

Aerobics are gospel to some in the fitness industry, yet to others, aerobics are the complete antithesis of muscle building.

One camp tells us over and over about the proven benefits of aerobic training such as strengthened heart, decreased body fat, lowered blood pressure, and lowered cholesterol, not to mention the claims that it synergistically helps prevent depression, disease, and even onset of osteoporosis while increasing a sense of well-being.

The other camp believes that aerobic exercise decreases testosterone production, increases cortisol production, lowers immune system efficiency, decreases limit strength, and severely handicaps potential hypertrophic gains from strength training.

With all these conflicting data, what is a bodybuilder to do?

The answer is certainly not to spend hours performing high-intensity aerobic exercises.

Studies have shown that intense aerobic exercise performed over long durations can greatly increase cortisol levels and oxidative stress; in other words, long-term aerobics performed at a high intensity will suppress your immune system and open up the catabolic door, counteracting your muscle-building goals.

A 2004 study published in the *Canadian Journal of Applied Physiology* showed rats that swam intensely three hours a day, five days a week, for a period of four weeks not only experienced decreased testosterone levels but also, in fact, experienced a decrease in size of testes and other accessory sex organs. Other studies have shown that aerobics in excess can potentially lower testosterone levels. One 2001 study published in the *Journal of Xi'an Institute of Physical Education* demonstrated that moderate aerobic exercise did not have detrimental effects on testosterone levels.

Low testosterone levels can sabotage the potential gains of a bodybuilder. Besides decreased motivation and increased lethargy, hormones influence everything indirectly. With a less-than-adequate production of testosterone, your gains will be suboptimal.

However, other studies show the superiority of aerobic training for fat loss over resistance training, some show a huge reduction in testosterone levels, and still others show virtually no effect. The reason for conflicting information is study design.

Studies that demonstrate aerobic exercise as superior to strength training for fat loss generally have subjects performing hours of intense cardiovascular exercise weekly, and the strength-training routine is rarely explained in detail.

Generally, the routine will be described as three sets of 15 reps, on whatever machine is popular at the time. Machines, though effective in some instances—for example, to overload a muscle through the principle of isolation—are generally inferior to barbells, dumbbells, and even body weight exercises. All stability is eliminated, and synergist muscles are robbed of the potential work performed.

Machines are generally performed in the most advantageous position: Leg presses are performed lying down, unlike the squat, which is performed standing. Except for isolation, machines are considerably easier! If we had to choose between machines and free weights, the choice would be simple: free weights; more work is performed.

This is study design flaw number one!

Secondly, aerobic protocols consist of specific parameters and variables (i.e., 45–60 minutes of swimming performed at 75% of heart-rate max for six weeks straight, five times weekly). As your conditioning increases, 75% of your max heart rate will be adaptable; initially, you may have

performed 30 laps at this intensity, but by the end of the study, you may be completing 40 plus. As you adapt, the amount of volume you perform increases even though relative intensity does not.

This variable adjustment is not made with resistance training. Besides, three sets of 15 reps with 50% of your one-repetition max on a machine are easy. Unless the subject is 100% "green," no sort of overload will take place. In all seriousness, who in his or her right mind takes one-repetition maxes on a machine? Fifteen repetitions on the squat with 70% of your one-repetition max will have your muscle fibers screaming.

There are many reasons aerobic training protocols perform better on paper. Sometimes, though, it is simply outright bias.

If it came down to resistance training or aerobic exercise for improved health and body composition for a middle-aged client, resistance training reigns superior.

Obviously, this is a no-brainer for the bodybuilder.

After weight training, your metabolism is boosted for up to 36 hours, unlike with aerobics, so you will literally burn more calories while you sit and relax or even sleep. A few extra calories an hour for 36 hours, over the long haul, will add up.

Furthermore, each additional pound of muscle can burn up to 50 extra calories a day. Not to mention that aerobic training benefits can be attained through intense peripheral heart action training or circuit training. Strength-training benefits cannot be attained through aerobic training. It's not just calories burned during exercises: it is what happens afterward.

Outright bias sometimes plays a role in flawed study design.

Dr. Kenneth Cooper, who founded the Cooper Clinic in 1967, published the book *Aerobics*. Cooper and others like him pushed an aerobics-first agenda using selective science to help advance their dogma. Because of initial leaders like this in physical culture post World War II, Americans have always been spoon-fed the idea of aerobic superiority for health. Icons such as John Grimek and Bill Pearl, who countered this notion, never received the mainstream acceptance Cooper did.

Obviously, with all these negatives associated with aerobic training, no single type of long, slow cardio has any place in the regimen of serious bodybuilders. Correct?

Not exactly. Aerobic training for bodybuilders is not a black and white matter.

A major concern bodybuilders have with aerobic training is the negative effect it could have on muscle strength and hypertrophy gains. In other words, concurrent training can lead to interference of specific adaptations. Concurrent training consists of training multiple qualities in the same training phase and, many times, in the same training session. The biggest issue is the multiple qualities the athlete is attempting to improve end up competing for adaptation. This can confuse the body regarding the proper response and ultimately inhibit optimal training adaptations; this is known as the interference phenomenon. People don't bench press 500 pounds and run a five-minute mile or win the Boston Marathon and qualify for the Olympia. Properly applied interval training and other conditioning modalities discussed later in the text will show you how to maximize fat loss while minimizing interference.

The studies that show the ill effects of muscle hypertrophy, anabolic hormonal deficiency, and decreases in strength as a result of concurrent training have some commonalities. What it comes down to is that intense cardiovascular exercise for more than 30 minutes at above 75% max heart

rate intensity, with a frequency of three times or greater per week, will be counterproductive to strength and muscle gains. An easy way to estimate max heart is 220 minus your age; so if you are 20 years old, 220 – 20 = 200 max heart rate.

Research thus indicates that long jogs are out as a way to optimally increase strength and muscle mass. Walking, however, could be a great alternative to long jogs. Make your walks fun instead of slaving away on the treadmill. On days you are not training, go outside, get some fresh air, and take the dog along. There is no need to spend hours on the treadmill to get lean. Interval training a few times a week, coupled with 20–30 minutes of walking two to three times a week, will keep you healthy, happy, lean, and mean. Shoot for keeping your heart rate in the 55%–70% range of your max heart rate on days that you are not interval training.

Here are some benefits of aerobic activity, such as moderate walking a few times a week:

- Increased general physical preparedness (GPP)
- Decreased delayed onset of muscle soreness (DOMS), thus enhancing recuperation
- Increased heart health
- Decreased stress
- Help in maintaining healthy joints/muscles
- Decreased body fat
- Increased energy levels

INTERVAL CONDITIONING

The conditioning fat loss wars people seem to fall into are two extremist camps. When it comes to conditioning for fat loss, there is the traditional long, slow cardio camp and, of course, the group that avoids the word "aerobic" like the plague.

In 1994, at the Physical Activities Science Laboratory at Laval University in Canada, Angelo Tremblay and some of his colleagues tested the long-held belief among most exercise and medical professionals that long, slow cardio at a low intensity is superior for fat loss. In fact, they compared the impact of moderate/low-intensity with **high intensity interval training (HITT)** in hopes of discovering which was superior in achieving fat loss.

High Intensity Interval Training (HIIT): A cardiovascular exercise strategy alternating short periods of intense anaerobic exercise with less intense recovery periods.

One group did 20 weeks of endurance training, and the other group did 15 weeks of high-intensity interval training. The cost of total

energy expenditure was much higher in the endurance-training group than in the interval group.

Additionally, Tremblay and his associates found that the endurance group burned nearly *twice* the number of calories during training than did the interval group. Lo and behold, however, skinfold measurements showed that the interval training group lost more body fat than the endurance training group did.

This may not seem to make sense at first glance, but the team found, "When the difference in the total energy cost of the program was taken into account…the subcutaneous fat loss was nine fold greater in the HIIT (interval training) program than in the ET (endurance training) program."

In layman's terms, interval training trumped long, slow cardio for fat loss.

The interval trainees attained nine times the fat loss for every calorie burned during training.

The Laval University researchers found that metabolic adaptations that resulted from interval training may lead to enhanced lipid utilization post exercise, effectively accelerating fat loss.

Fat is the fuel for lower-intensity exercise, and carbohydrates are the fuel for higher-intensity intervals. Although excess dietary fat can cause unwanted fat gain, excess carbohydrates can, too. This study confirms the need to look beyond the scope of what macronutrient is fueling the workout or how many calories are burned during the workout. We must also look at what happens post workout. Intervals stimulate your post-workout metabolism to a greater degree than long, slow cardio does. Additionally, studies have shown intense intervals have stimulate increases in anabolic hormones post workout.

This is why interval training has so many diehard advocates and supporters. Science confirms that interval training is highly effective for fat loss. "Compare the physiques of top-level sprinters to top-level distance runners" is a simplistic, logical response many give when asked why they feel interval training is superior.

Izumi Tabata has conducted research for the National Institute of Fitness and Sports in Tokyo, Japan. In terms of aerobic benefits, Tabata demonstrated that a program of 20 seconds of all-out cycling followed by 10 seconds of low-intensity cycling for four minutes was as beneficial as forty-five minutes of long, slow cardio was!

Tabata training is now a popular form of interval training that includes performing an activity all out for 20 seconds, followed by a 10-second

Tabata Training: A popular form of interval training that includes performing an activity all out for 20 seconds, followed by a 10-second rest interval.

rest interval. Some popular methods of Tabata training include jumping rope, burpees, and kettlebell swings, along with many others. Numerous studies also confirm the effectiveness of interval training as an enhancement to aerobic capacity.

At this point, it probably sounds like a no-brainer; just perform interval training during every training session and get lean.

Hang on: not so fast.

Muscle grows from exercise via muscle damage, mechanical tension, and metabolic stress. Intervals generally work the same way, so they must be treated with respect.

The CNS is primarily affected by high-intensity work and takes at least 48 hours to recover, so interval training requires adequate recovery very similar to what intense resistance training needs.

Interval training, in the true sense, is all out.

The studies that confirm the effectiveness of interval training have subjects performing intervals with 100% intensity. From personal problems to intense training, all impose stress on you; when the right amount of stress is imposed from training, you adapt and improve. Remember, if you are training intensely multiple times per week and have a full-time job and a family, stressors are acting on you from all directions. Without proper planning, training will no longer serve as a catalyst to meet your physical goals; it will break you down.

The more advanced you become as a bodybuilder, the more stress you impose on yourself. Studies have actually shown that the more weight someone can lift, the longer the recovery time needed.

If you can squat 200 pounds for a max, 75% of your max is 150 pounds; you may need only a couple of minutes to fully recover from a set of 10 reps. For a 700-pound squatter, 75% would be 525 pounds; over five minutes may be needed to fully recover.

Though the relative percentage is the same, in reality, squatting 525 pounds for reps will place a much greater strain on your CNS and musculoskeletal system than doing so with 150 pounds. The stronger you get, the less interval training you will be able to handle because of the heavy loads handled in training.

A beginning bodybuilder may be able to do three days a week of interval training, whereas a more advanced bodybuilder may be able to do only one to two days a week or none at all; high-intensity, high-volume strength training with short rest intervals is interval training in itself. Adaptations to your training are a consolidation of imposed stressors, which determine your muscle gains, fat loss, and strength levels.

As with intense resistance training, extreme stress is placed on the central nervous system and musculoskeletal system. Look at sprinters. They produce huge force while sprinting, and this places a large amount of stress on muscles, connective tissue, and the CNS.

Now imagine a 275-pound bodybuilder sprinting.

Be careful!

If you have health problems or have not been training on regularly, think twice about implementing intervals and consult your physician before beginning interval training. The risk of overuse injuries will drastically increase if intervals are overdone. Rushing into these types of workouts before you have a sufficient base will great increase your chance of injury. Start slowly. Try just one or two high-intensity intervals at first. As conditioning improves, begin to challenge yourself.

Here are some interval training examples.

BARBELL COMPLEXES

Barbell Complexes: Barbell complexes are performed as quickly as possible, moving from exercise to exercise with no break.

Do you want to find out what you are made of? Try barbell complexes. Not only are these one of the greatest metabolic conditioners and fat loss modalities, but also they are one of the best tests of mental fortitude. It is for this reason that the ISSA offers a word of caution that ***barbell complexes should only be used by advanced lifters*** who display great technique in barbell movements. An advanced lifter would be defined as someone with at least two years of serious strength training under his or her belt. ***If you have any doubts at all, avoid these***. There are plenty of other ways to condition that will preclude the interference effect.

If you are doing barbell complexes and find they are not challenging, you are not loading the bar with enough weight or not giving a sufficient effort. Barbell complexes potentially serve as a viable alternative to sprints for heavier athletes.

Barbell complexes are performed as quickly as possible while maintaining proper form, moving from exercise to exercise with no break.

To construct a complex, you may do five to eight squats, followed by five to eight squats to presses, followed by five to eight good mornings, followed by five to eight power cleans, followed by five to eight bent over rows, and finally finished off with five to eight deadlifts.

The beauty of barbell complexes is that they can be arranged somewhat specific to the muscle group being worked; if you train legs Monday and chest Tuesday, it would be counterproductive to do extremely intense

intervals that emphasize legs and lower back; doing so will not allow the muscles to recover.

On a leg day, a barbell complex might look something like this: overhead squats, squats, reverse lunges, front squats, and Romanian deadlifts. On a back day, it might look something like this: good mornings, power cleans, hang cleans, deadlifts, and bent over rows.

Sound tough? Your fortitude will be in for a test.

Some points to remember when performing complexes:

- Use compound exercises
- Perform exercises as fast as possible while maintaining proper technique
- Do not rest between exercises
- Try your best not to drop the bar
- Start with an empty bar and add weights in increments of 5 or 10 pounds
- Do 5–7 exercises per complex, each set consisting of 5–8 repetitions
- Rest 1 to 3 minutes between sets, do not exceed 4 sets, do not exceed 15 minutes' total duration
- Barbell complexes are intense interval workouts and are included in your total of interval workouts

Variable Manipulation: Different elements you can vary to increase (or decrease) intensity. Rest periods, weight on the bar, and number of sets are all examples of variables you can change.

ZEN AND THE ART OF VARIABLE MANIPULATION

When progressing through barbell complexes, be intelligent in how you increase intensity! Simply piling more pig iron on the bar every session will result in cessation of progress.

These are some variables you can manipulate to increase intensity:

- **Rest periods**—decreasing the rest periods increases intensity. If a three-minute rest interval is becoming easy, try using the same weight but decreasing the rest interval between complexes; knock off 15–30 seconds between each session, eventually working down to a one-minute rest interval. All of the sudden you are accomplishing four complexes in the same amount of time it used to take to do two.
- **Weight on the bar**—increasing weight on the bar increases

intensity. But remember, if you cannot complete more than one set, decrease the bar weight.

- **Number of sets**—increasing number of sets increases intensity. After you get up to four complexes, pile on more pig iron.

Barbell complexes can expedite fat loss but also expedite overtraining; I do not suggest you do them more than twice a week. These will test you mentally and physically. I have given you some practical examples, so try those. I have also laid out the variables to be taken into account when designing a complex. Play around and find out what works best for you.

STRONGMAN TRAINING

Although top strongman competitors carry a much higher body fat percentage than top bodybuilders do, many carry a much larger amount of lean body mass.

Strongman events are conducive for building muscle because they are very heavy, inducing extreme mechanical tension. Strongman events also cause enormous amounts of metabolic stress; generally, they take place for 30–60 seconds. Moreover, the movements are compound and cause extreme muscle damage. Svend Karlsen and Juoko Ahola look like lean, off-season bodybuilders, whereas Mariusz Pudzianowski essentially looks like a competition bodybuilder year-round, but bigger. Still need proof? Google images of Derek Poundstone or Bill Kazmaier, and you will have an entirely new picture of what muscle hypertrophy looks like.

Strongman events can also be great for conditioning/fat loss as a finisher at the end of your workout and also aid in the muscle building process.

Here is an example of some strongman events

that can be used as finishers in your training and what day they will correspond to:

Legs Day

Backward Sled Drags—facing the sled, lean back and pull with arms straight (never bend them). This has a huge emphasis on the quads. Perform 20–40 yards, 2–6 sets.

Forward Sled Drags—facing away from the weight, walk forward taking large steps, maintaining an upright posture. This has emphasis on glutes and hamstrings. Perform 20–40 yards, 2–6 sets.

Lateral Sled Drags—these can be performed with the sled attached to a weightlifting belt. Stand sideways to the sled and step laterally. This primarily targets the gluteus medius, but the gluteus minimus, tensor fascia latae (TFL), and sartorius play important assisting roles.

Other events like yoke and front yoke could be used. I included ones that most people will have access to.

Back Day

Farmers Walk—This will build the entire back, traps, and even forearms because of the grip. If you do not have access to farmer's walk, implement by simply using dumbbells. Perform 2–4 sets for 20–50 yards. To make the exercise more difficult, add a turn.

Tire Flips—The best thing about tires is that they are free! Tires cost money for disposal, so anyone with used ones will be happy for you to take them off his or her hands. Tires work the entire body, particularly the posterior chain (back side of the body), and build explosive power. Do 5–8 flips for 2–4 sets. *Do not bend your arms* when lifting a tire off the ground; this exposes your biceps to an exacerbated chance of injury. Bicep tears are a common injury with tires, so proceed with caution.

Legs and back are the most common muscles used in strongman, but other techniques can be employed for other muscle groups. Other examples could be curl sled drags for biceps, crucifix hold for the shoulders, and chest incline log press for the chest.

You are not trying to become a strongman, but some unorthodox training can produce some unorthodox results. Remember, the Wright Brothers were not aeronautical engineers, yet they were the first to fly. Sometimes superior results require outside-the-box techniques.

KETTLEBELL INTERVAL TRAINING

In the fitness industry, things run in extremes. Just look at flexibility; studies have shown static stretching pre-workout decreases force production, yet now some basically purport that if you ever stretch you will be weak and prone to injury.

On the other side are those who believe that yoga is more important to MMA fighters than sparring is. Think of the other extremes: no carbs, low fat, and BOSU balls, and the list goes on, my friends.

Kettlebells fall into this extremist camp.

Many times, advocates will imply you can develop the endurance of a marathon runner, physique of a bodybuilder, strength of an elite powerlifter, flexibility of a yoga instructor, and speed of a world-class sprinter without pig iron or any other modalities.

This is simply false.

Kettlebells look sort of like a shot put or cannon ball with a handle welded to the top. For centuries, top Russian athletes have used kettlebells for strength training.

In years past, circus strongmen used these

implements as part of their acts. Today, many folks are integrating kettlebell training into their strength and conditioning regimens.

Could they possibly foster fat loss?

Advocates of kettlebell training are quick to point out that kettlebells can simultaneously build core stability, coordination, endurance, strength, power, and flexibility.

Okay, but what about fat loss?

A recent study at the University of Wisconsin–La Crosse demonstrated that intense kettlebell intervals burn calories at the same rate as a mile run at a six-minute pace (that is, 1,200 calories an hour). Clearly, fat loss is a byproduct of intense kettlebell training.

Another study commonly cited to demonstrate the effectiveness of kettlebell training was conducted in 1983 by Aleksey Voropayev, famed Russian gymnast and researcher. This study showed that for a group of male soldiers, kettlebell training was more effective than were traditional military training techniques.

In this study, one group followed a standard military regimen of pull-ups, 100-meter sprints, standing broad jumps, and distance runs. The other group used nothing but kettlebells and kettlebell training. Interestingly, at the end of the experiment, the kettlebell group participants scored higher on every exercise in which they were tested.

This study demonstrated that kettlebells not only enhanced the strength tests, as one would guess, but also increased endurance and power. This may explain why some believe that kettlebells are the magic bullet. Kettlebells are certainly not the magic bullet for bodybuilding, but they are fun and do help you burn body fat.

Three effective kettlebell exercises are clean and jerks, snatches, and swings. Here is a good circuit for conditioning and fat loss; complete the circuit without a break:

- 10 Kettlebell Swings
- 30 seconds of Jump Rope
- 5 Clean and Jerks (each side)
- 30 seconds of Jump Rope
- 5 Snatches (each side)
- 30 seconds of Jump Rope

Follow this circuit with a one- to four-minute break and repeat the circuit three times. Remember, these circuits are an intense form of interval training, if you give 100%. These count in your weekly total of interval workouts, so don't try and do a barbell complex twice a week and then do this circuit two to three times. All intense training is a stressor; without recovery, you will be in a perpetual catabolic state.

JUMPING ROPE

The iconic image of the old pug getting ready for a prizefight by skipping rope is a beautiful image. Prizefighters have reaped the benefits of jumping rope for centuries. Jumping rope can burn up to 1,000 calories per hour, making it one of the most efficient fat-burning workouts available.

Unlike other forms of interval training that are much more stressful on the CNS, jumping rope spares significant stress on muscles and connective tissues.

Furthermore, jumping rope tones muscles throughout the entire body and develops lean muscles in all major muscle groups. Of course, jumping rope optimizes conditioning and maximizes athletic skills by combining agility, coordination, timing, and endurance. Most importantly for you, it can help burn body fat.

Jumping rope is extremely practical because, unlike advanced kettlebell exercises, the learning curve is easy. Jump ropes are portable and inexpensive and can be purchased for less than $10. If you go on vacation, throw your jump rope in your bag, and you'll have no excuse not to do your conditioning work.

For your jump rope program, start by jumping rope 30 seconds and resting one minute for six sets. Depending on ability, add 10 seconds per week or workout. Make it your goal to complete six sets of three minutes of jump rope, with a 30-second rest interval. When you are able to complete six sets of three minutes, body fat will have melted off, and conditioning will be at a completely new level.

A FEW LAST WORDS

Old-time bodybuilding champions did much less cardio than many do today. There is no reason to spend hours a day doing long, slow cardio as some bodybuilders do.

The reason many of them are able to get away with this is because of drugs. These substances can literally change human physiology—both long and short term—and as many have discovered, not for the better. Countless studies show endurance athletes have much lower testosterone levels than their anaerobic counterparts do, so if bodybuilding and packing on size and strength is your goal, endurance training should not be highest on your priority list.

Fat loss comes from strength training and dieting!

If you're relying on long, slow cardio or even interval training for fat loss, your body is telling you that your diet is not in check.

The age-old truth remains the same truth today: Strength training and diet are the keys to fat loss.

TOPICS COVERED IN THIS UNIT

Anatomical and Physiological Basis of Stretching

Flexibility Assessment

Constraining Factors

Inflexibility and Injury Potential

Specificity and Flexibility

How Much Flexibility Is Enough?

The Effect of Body Temperature on Flexibility

Tension Magnitude during Stretching

Duration

Breathing and Relaxation

Delayed Onset of Muscle Soreness (DOMS)

Periodization of Stretching

Types

The Warm-up

Stretching Routines

A Few Last Words

UNIT 7

STRETCHING

Although **flexibility** improvements are not directly related to increases in muscle hypertrophy, the fact remains that some bodybuilders completely ignore flexibility work, and this is not wise. As will be discussed in this unit, having adequate flexibility is vital to optimal bodybuilding performance.

The stereotype has always been that as muscle increases, a person's flexibility decreases. This is gym lore. Anyone who is a serious fan of contemporary pro bodybuilding will remember seeing photos of Ronnie Coleman doing the splits on stage. Folks who saw that were amazed by how someone with so much muscle could also have such amazing flexibility.

The role of joint flexibility in general fitness and athletics has received great attention for the last few decades, and in recent times, bodybuilding magazines have started publishing articles about stretching, warming up, and cooling down. Everyone needs a certain level of flexibility and mobility. The question is, how much is enough?

The ISSA has advanced the following definition of flexibility: the ability to flex, extend, or circumduct the body's joints through their intended full range of motion without substantial decrement in limit strength.

Flexibility: The ability to flex, extend, or circumduct the body's joints through their intended full range of motion without substantial decrement in limit strength.

Sarcomere: The basic unit of muscle contraction.

Proprioceptors: Your body's built-in safeguards against severe muscular injury.

Golgi Tendon Organ: Located at the musculotendinous junction, it detects the magnitude of mechanical stress on the muscle. When excessive tension develops, the GTO causes the motor cortex of the brain to terminate muscle contraction and relax.

Pacinian Corpuscle: Small, elliptical bodies that lie in close proximity to the GTOs. They are sensitive to quick movement and deep pressure.

Note that the term *flexibility* refers only to joints, not to muscles or other soft tissues. The terms *loose, supple, stretched, extended,* and *elongated* are more appropriate descriptions for these tissues.

Flexibility is important, but significantly improving a joint's range of motion without also improving the strength of the surrounding musculature (especially at its new range of motion) can be an invitation to injury.

This is because an increase in joint flexibility (an additional 5 degrees, for example) produces a decrease in overlap between the affected muscle fibers. This results in a substantial reduction in force output. For example, if you chronically train squats high, when you finally squat to depth, you will be weak in this new unchartered territory.

The take-home message is this: as flexibility increases, take measures to increase strength in these extended ranges of motion.

ANATOMICAL AND PHYSIOLOGICAL BASIS OF STRETCHING

Understanding flexibility starts with a basic knowledge of cellular muscle anatomy and physiology.

Let's examine the **sarcomere** (the basic unit of muscle contraction) and the **proprioceptors**, specifically, the **Golgi tendon organ** (GTO, and no,

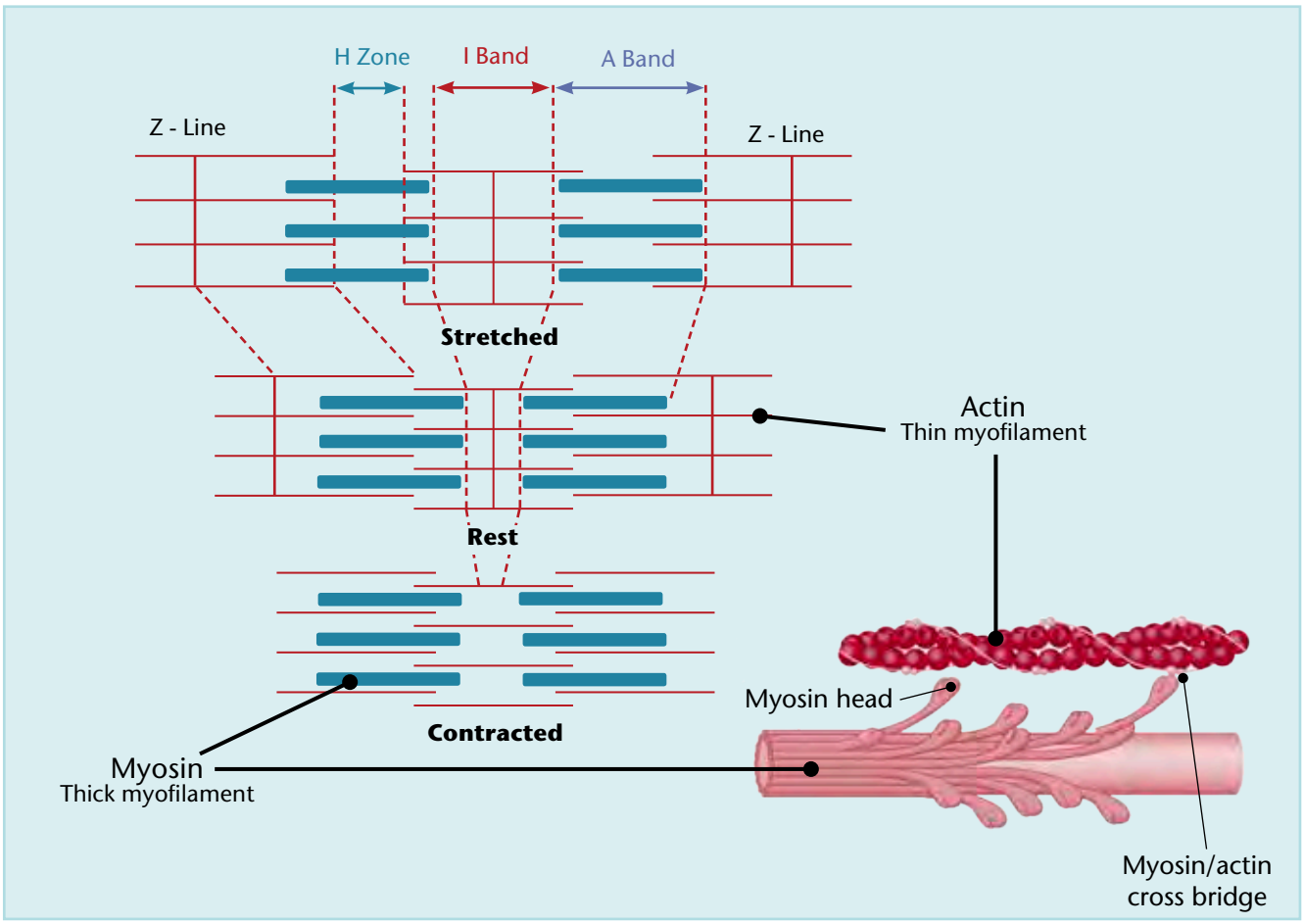


Figure 7.1 Structural rearrangement of actin and myosin myofilaments while fully stretched, at rest, and contracted

it's not a classic muscle car from the 60s and 70s), the muscle spindle, and the **Pacinian corpuscles**.

THE SARCOMERE

Muscle fibrils have the ability to change length because they consist of overlapping strands of protein polymers called actin (the thin strands) and myosin (the thicker strands).

The boundaries of the sarcomere are called Z disks, to which the actin filaments are attached. In the center of the sarcomere are the myosin strands, which are composed of two globular heads (known as cross-bridges) and a long tail.

The cross-bridge heads of myosin function much like boat oars do as they reach out, attach, and pull on the actin filaments, causing the Z disks to move toward one another. The result is muscle contraction.

When you stretch a muscle, the opposite occurs. During the stretch, the fibers elongate as each sarcomere extends to the point where no overlap between the thick and thin filaments exists.

At this point, the remaining stress is taken up by the surrounding connective tissue. If the stretch tension continues to escalate beyond this point, however, microscopic tears develop both in the connective tissues and within the sarcomere itself. Such microtraumatic injuries eventually heal, but they can leave the muscle fiber less capable of contraction and extension.

THE PROPRIOCEPTORS

The neuromuscular system has built-in safeguards against severe muscle injury. These safeguards take the form of proprioceptors that sense changes in muscle tension. When these changes are too sudden or intense the proprioceptors inhibit the nervous impulse sent to the muscle.

Three primary proprioceptors are involved in stretch inhibition: the Golgi tendon organ (GTO), the muscle spindle, and the Pacinian corpuscle.

The GTO is located at the musculotendinous junction. It detects the magnitude of mechanical stress. When excessive tension develops, the GTO causes the motor cortex of the brain to terminate muscle contraction and relax. The GTO is not sensitive to the rate of force development—only to the absolute value of tension that develops within the muscle.

The muscle spindle is actually a specialized muscle fiber that detects excessive stretch within the muscle. Muscles that are responsible for fineness of movement contain more muscle spindles per gram than do muscles responsible for gross movements. Unlike the GTO, the muscle spindle does not relay signals through the motor cortex; as such, it is not considered a feedback loop, but rather an inhibitory knob. Resetting the muscle spindle is the mechanism of proprio neuromuscular facilitation (PNF) and contract-relax stretching methods.

Pacinian corpuscles are small, elliptical bodies that lie in close proximity to the GTOs. They are sensitive to quick movement and deep pressure. As compared with the GTO and muscle spindle, the inhibitory role of this organ is not well understood.

What are the implications for bodybuilders and others trying to improve joint mobility? Considering the anatomical safeguards, you can easily see that longer, frequent periods of stretching with less tension will produce greater results than will short, intense bouts of stretching (which tend to trigger the proprioceptors).

Soreness after a stretching session is a sign that hydroxyproline and other biological mortars have been released into the muscle fiber to help repair damaged tissues. Post-stretching soreness can indicate an overly intense stretching regimen that is not needed for the bodybuilder.

FLEXIBILITY ASSESSMENT

ASSESSING RANGE OF MOTION (ROM)

Specific joint **range of motion** (ROM) is measured with a goniometer, a specialized protractor with two arms that rotate about one another. A calibrated scale at the vortex of the arms is used to determine ROM in millimeters (mm). Although a goniometer is normally reserved for therapeutic applications, fitness professionals can nevertheless make use of several standardized tests with which to assess ROM in their clients.

Sit and Reach

The Sit and Reach test is used to assess trunk flexion, a function of hip and spine flexibility on the sagittal plane. The primary muscles limiting trunk flexion are the hamstrings. The subject sits on the floor, legs together and extended. The subject leans forward with outstretched arms, attempting to touch the toes (or, if possible, to go beyond the toes) by flexing the trunk.

Supine Hamstring Assessment

Hamstring length can also be assessed by having the subject lie on his or her back with both legs

together and extended. The subject lifts one leg (keeping it extended) in the sagittal plane until significant tension develops or until the subject attempts to compensate by raising the other leg. If the raised leg can be brought to a vertical position prior to significant tension developing, hamstring flexibility is adequate. This test can also be used as a static-active stretch for the hamstrings.

Trunk Extension

For this test, the subject lies face down on the floor, in the start of a push-up position. The subject attempts to raise the trunk off the floor by extending the arms, while keeping the pelvis against the floor. The subject should be able to completely extend the arms while keeping the pelvis against the floor. This test can also be used as a static-active stretch for the anterior trunk muscles.

Hip Flexors

The subject rests on one knee and one foot similar to holding a football for a place kick. The front heel and rear knee should be approximately 12 to 18 inches apart. The subject pushes the rear hip down toward the floor. Viewed from the side, the subject should easily be able to align the pelvis between both knees such that all three are in a straight line. This test can also be used as a static-active stretch for the hip flexors.

Range of Motion: The full movement potential of a joint.

Shoulder Flexibility

The subject lies face up on a table such that the lower legs hang off the end. Next, the subject raises arms overhead, keeping the arms extended and hands close together. The subject should be capable of resting the entire arm overhead against the table, without excessive arching of the back.

Bilateral Range of Motion Deficits

Even more worrisome than a range-of-motion deficit is the discovery of a **bilateral deficit**, in which a joint on one side of the body has a significantly different ROM from the corresponding joint on the other side of the body.

Bilateral Deficit: When a joint on one side of the body has significantly different ROM.

Take the old-time bodybuilder who can fully extend one arm but not the other. In this case, one side has full ROM, and the other side is lacking full ROM, so a bilateral deficit exists. An effective prescription would be not to dump pressing exercises altogether but just to use dumbbells, which, unlike barbells, will not cause overcompensation. Continue trying to regain the lost ROM by completing exercises through a full range of motion and by performing targeted stretches. More times than not, this will correct

the problem. However, in extreme cases, with bone-on-bone blockage, surgery may be the only viable solution to correct ROM issues. Significant bilateral deficits can lead to postural erosion and can also impair how much weight you can lift. Even if health is not a consideration, it's important to keep this issue in mind!

CONSTRAINING FACTORS

As with all other bio-motor abilities, the potential to increase joint flexibility to an extreme degree is to a certain extent genetically predetermined. Younger individuals are generally more flexible than older people are, and girls are usually more flexible than boys are.

Flexibility is affected by past injuries, if any, strength levels, core temperature, time of day, stress levels, or even mood and personality type. These constraining factors can be categorized into those that are beyond the individual's control (adhesive scarification, joint shape, etc.) and those that can be influenced through training. Some factors, particularly joint shape, can be altered through intensive training during childhood, which is commonly seen in the training of gymnasts and dancers.

INFLEXIBILITY AND INJURY POTENTIAL

Weight training through full ROM increases flexibility in many instances, or it remains neutral; never does weight training decrease flexibility. However repetitive, limited ROM training over a prolonged period can create shortened muscles. This is not to say that incorporating partials into a program should never be done, but rather that partials need to be systematically incorporated into a program for specific frequencies and durations. Bodybuilders lifting chronically with a partial range of motion will lose flexibility over time.

The old saying, "full range of motion for full development," most certainly holds true when it comes to flexibility.

Countless examples exist whereby inflexibility leads to injury. Most frequently, you will encounter problems caused by shortened hip flexors, overly tight hamstrings, and overly tight quadriceps. This is because long periods of sitting where the hip flexors contract repeatedly over a reduced range of motion can shorten the psoas and iliacus muscles.

Chronically shortened muscles can be the first step in a series of events leading to injury. Shortened hip flexors, to use the previous example, can lead to a reduction of the normal lordotic curve of the lumbar spine. This can impair the spine's load-bearing and shock-absorption capacity; in layman's terms, your squat will suffer because you cannot maintain an adequate arch.

When the spine cannot function normally, a wide range of injuries can result. Overly tight hamstrings have the same effect on the lumbar spine. Watch an overly tight bodybuilder try to perform an Olympic squat; if the hamstrings are tight, the pelvis will rotate posteriorly, which is biomechanically inefficient and invites a back injury.

Overly tight quadriceps can pull the patella upward (proximally), causing it to track abnormally high on the femoral groove. Such a condition can potentially result in a softening of the articular cartilage of the kneecap, leading to pain, inflammation, and eventual debilitation—a condition known as chondromalacia patellae.

SPECIFICITY AND FLEXIBILITY

Specificity is obviously of profound importance if training is to be successful. Like all other bio-motor abilities, joint flexibility can be enhanced only if the training methods are specific to the desired result. Flexibility is specific to three criteria:

1. **Joint specificity:** A flexibility training program for the hips, for example, will not improve flexibility in any other joint. The joint-specific nature of flexibility training does not necessarily mean that all joints must be targeted with flexibility exercises. Flexibility training can place a priority on joints that are most in need as a way of maximizing training efficiency.
2. **Speed specificity:** To achieve maximum effectiveness, stretching exercises must be very similar in form and speed to the skill you are trying to improve. Slow, static stretching, for example, will not improve flexibility in fast movements nearly as well as dynamic stretching will. Conversely, dynamic stretching methods have limited ability to improve a static skill, such as a split on the floor. In bodybuilding, generally, dynamic stretching will have the best transference.
3. **Resistance training as a contributor to increased joint flexibility:** Properly conceived resistance training programs can have a beneficial effect on flexibility levels. In fact, whatever your level of flexibility, the primary concern is the degree of strength throughout a joint's full range of motion. Two critical points are to perform resistance exercises through the involved joint's full range of motion and to work antagonistic pairs of muscles equally (i.e., biceps and triceps).

HOW MUCH FLEXIBILITY IS ENOUGH?

This, of course, varies from individual to individual, but it can safely be said that individuals need enough flexibility for any situation they will normally encounter in day-to-day life, plus a little bit more. This "little bit more" is called the flexibility reserve.

Conversely, if adequate flexibility is lacking, the difference between what you have and what you need is called your flexibility deficit. Of all the bio-motor abilities, joint flexibility is perhaps the simplest to develop. The methods involved are well understood, and they do not require a great deal time, effort, or specialized equipment.

THE EFFECT OF BODY TEMPERATURE ON FLEXIBILITY

Body temperature is an important consideration when attempting to improve joint flexibility. Increased temperature helps facilitate increases in ROM, whereas decreased temperature tends to preserve increases in muscle length. Before a person performs stretching exercises, body temperature must be elevated through a warm-up.

The warm-up can be passive, meaning a hot bath or shower, or, preferably, active, meaning a brief session of cardiovascular activity that is classified as a general warm-up. The general warm-up can be five to ten minutes on the bike or elliptical and, as with training, a warm-up goes from general to specific.

Getting more specific is dynamic stretching, and the final part of the warm-up should be performing—at a lower intensity—the activity you are warming up for. If it is chest day and your first

exercise is bench press and the first set is with 250 pounds, a specific warm-up would look like this:

Bar x 6 x 2 sets, 95 x 6 sets, 135 x 5 sets, 185 x 3 sets, 225 x 1 set

Remember, it's a warm-up, not a pre-exhaust!

This helps dial in the motor pattern and specifically warm up the muscles you will be using. If the subsequent exercise works the same muscle group as the preceding exercise does (i.e., an incline press performed after a bench press), it will require less warm-up; many times a single set will suffice.

Although many individuals use stretching as the entire warm-up, dynamic stretching is simply part of the warm-up and should always be done after a general warm-up.

Pre-stretch muscular activity (either of a resistance training or cardiovascular nature) is important in two regards. First, body temperature is elevated.

Second, muscles are subject to thixotropy, which is the tendency of gels to become less viscous after being shaken or otherwise disturbed by outside forces.

This explains why periods of inactivity tend to cause muscular stiffness (probably resulting from microscopic bonding and adhesions between actin and myosin strands) and why muscular viscosity is restored when muscles are subjected to movement.

The most appropriate time to stretch a muscle (from the perspective of body temperature and the thixotropic effect) is either after resistance training the muscle in the weight room or after engaging in cardiovascular activity.

In this way, the target muscle tissues are warm and viscous (which facilitates lengthening) but are in the process of cooling (which tends to preserve long-term improvements in length).

TENSION MAGNITUDE DURING STRETCHING

Muscle tension is another important consideration for the person stretching. Stretching methods can range from intuitive catnap limbering (which is useful for releasing adhesions and microscopic tissue bonding after periods of inactivity) to aggressive stretching regimens designed to radically increase a joint's range of motion (as performed by dancers, martial artists, and gymnasts).

Of course, discomfort and pain are subjective experiences, and individuals have varying tolerances to both. Stretch to the point of mild to moderate discomfort if the goal is to improve range of motion, but stop short of discomfort if the primary objective is to speed up the removal of waste products during or after a workout.

When stretching, your facial expression should be calm and placid. Facial tension might indicate excessive stretch tension.

DURATION

Ideal stretching duration can vary depending on many factors, primarily the type of stretching method being used (described subsequently).

Dynamic stretching for instance, involves several swings that last only a moment or so each. Static-active and contract-relax methods involve longer periods lasting up to a minute or more. Stretching sessions rarely last more than 20 minutes, with each individual muscle normally taking 2–3 minutes at most.

BREATHING AND RELAXATION

During the stretch, breathe normally, and visualize the muscles, tendons, and ligaments' lengthening during the stretch. Avoid breath holding, as this can increase blood pressure and general muscular tension.

Correct your breathing functions to enhance relaxation while stretching—particularly when exhalation is timed to coincide with muscle elongation. Recognize, though, that it is difficult to maintain muscular tension while exhaling.

DELAYED ONSET OF MUSCLE SORENESS (DOMS)

Although research does not confirm this, in the field, many swear by the notion that low- to moderate-intensity stretching exercises may be effective in reducing post-exercise muscle soreness (perhaps the best rationale for most people to stretch regularly).

Stretching (or massaging) the affected muscle is roughly analogous to wringing out a sponge, which serves to help rid the muscles of hydroxyproline and other waste products resulting from exercise-induced microtrauma.

A note of caution however: Aggressive stretching, as described earlier, may actually cause microtrauma. If the goal of stretching is to increase joint ROM, this is an unfortunate but unavoidable side effect. If though the objective is reduction of DOMS, stretching must be performed with reduced tensions.

PERIODIZATION OF STRETCHING

As with all training components (including nutrition), stretching exercises should be periodized throughout the training cycle. For individuals who do require high levels of ROM, the following points will be helpful when designing your overall training schedule:

- If flexibility is a weak area for you, focus on correcting it in the off-season and maintain it during contest prep.
- Excessive flexibility appears to be detrimental to some athletes involved in strength and power sports. For example, too much hip flexibility can weaken the stability of the low position in the squat. In addition, track and field throwers often report that a certain level of tightness in the pectoral region can facilitate elastic energy in the final stages of the throw; top bench pressers seem to agree.
- If the objective is to increase ROM, intensive stretching should not be performed every day, as the muscle and connective tissues need time to heal. Consider a schedule in which adaptive tension stretching occurs every other day, interspersed with days of light tension stretches.
- When reduction of DOMS is the objective, stretching exercises can be performed every day or nearly every day. The most effective method involves stretching muscles immediately after they have been resistance trained. If you wish to plan static stretching on a day when no resistance training occurs, perform a low-intensity 10–15 minute cardiovascular session (active warm-up) or take a hot shower, steam bath, or Jacuzzi prior to stretching.

TYPES

Static Stretching: Means a stretch is held in a challenging but comfortable position for a period, usually between 10 and 30 seconds.

Dynamic Stretching: Active movements of muscle that bring forth a stretch but are not held in the end position.

PNF Method: Involves a shortening contraction of the opposing muscle to place the target muscle on stretch. This is followed by an isometric contraction of the target muscle.

Contract-Relax Method: Method performed with a partner who carefully provides resistance for the muscle being stretched prior to actually stretching it.

STATIC STRETCHING

This is the form athletes and fitness enthusiasts most commonly practice. Although effective for recovery purposes, the static method is not as effective as the contract-relax method is (to be discussed shortly) in terms of achieving long-term increases in ROM.

Static stretching is contraindicated prior to resistance training, as numerous studies have shown it can temporarily lower strength levels, power output, and speed.

If this is of interest to you, read this study by the University of Texas, Arlington: "Acute Effects of Static and Proprioceptive Neuromuscular Facilitation Stretching on Muscle Strength and Power Output." Power and strength were both adversely affected when PNF or static stretching were performed pre-workout. Some still insist static stretching prior to working out reduces injuries and increases dynamic flexibility in the cage. Not one study though has ever demonstrated a reduction in injuries when static stretching was employed pre-workout or competition.

Two types of static stretching have been identified: In static-active stretching, you assume the desired position, move slowly toward your extreme range of motion for the joint you are stretching, and upon reaching the desired level of tension, hold for 10–60 seconds.

In static-passive stretching, you have a partner move you toward your maximum range of motion (ROM) as you relax and submit to the stretch. Although you should never bounce or jerk while performing static stretches, it is sometimes effective to pulse rhythmically several times, as long as you are well within your present range of motion.

During the pulsing rhythm, your nervous system will be able to anticipate and accommodate your movements, resulting in an effective stretch.

DYNAMIC STRETCHING

Used primarily by athletes who need to increase range of motion for sports skills, dynamic stretching involves swinging the arms and or legs in a controlled manner. It should be noted that dynamic stretching is different from ballistic stretching, as dynamic stretching consists of performing stretches where momentum and active muscular effort are used to stretch, and the end position is not held. An effort is made to propel the muscle into an extended range of motion not exceeding one's static

passive stretching ability. Pushing beyond this point, in a more explosive matter, would then become ballistic stretching. Ballistic stretching involves fast, bouncing movements and has a greater risk of injury.

Various patterns can be used. It is a good idea to do movements similar to those you will be training for the greatest transference. When stretching dynamically, care must be taken not to exceed the present range of motion for the joint(s) being stretched, or injury could result.

Several methods can be used to ensure the safety of this type of stretching.

First, establish an even, controlled rhythm, with swinging movements initially well within the current range of motion; then, gradually increase the amplitude of the movement until you are at the desired level of tension at the end point of the movement.

Second, the stretch reflex can be averted by stopping the moving limb prior to the target joint's reaching the end of its range of motion.

As an example, during a standing dynamic hamstring stretch, the individual can swing (kick) his or her leg into an outstretched hand, which stops the foot at the end of each swing, prior to the extreme range of the hip joints. The nervous system will anticipate this, and as a result, the stretch reflex will be minimized or even eliminated.

Please bear in mind that these are specialized movements, and care must be taken with their use. Never do dynamic stretching until a general warm-up of 10 minutes has been performed.

PNF METHOD

Originally developed by Dr. Herman Kabat, and then later refined by physical therapists Dorothy Voss and Margaret Knott, proprio neuromuscular facilitation (PNF) is defined as "a method of promoting or hastening the response of the neuromuscular mechanism through stimulation of the proprioceptors."

True PNF requires specialized training and is normally used only in a clinical setting with paralytic patients. Although many PNF methods exist, most forms involve dynamic, rotational, and angular movements done in accordance with verbal cues from a registered physical therapist.

CONTRACT-RELAX (CR) METHOD

Individuals within the fitness industry commonly refer to this method of stretching as PNF. However, we use the term *contract-relax* to distinguish it from true PNF.

The contract-relax method is performed with a partner who carefully provides resistance for the muscle being stretched—prior to actually stretching it.

The rationale here is that when you contract a muscle before stretching it, you inhibit the stretch reflex, or the body's protective reflex.

This reflex prevents you from reaching your potential range of motion. This built-in safety mechanism is set extremely conservatively, however, and "fooling" it through this type of stretching is quite safe when done properly.

One benefit of contract-relax stretching is that the targeted muscles become stronger in their extreme ranges of motion. Keep in mind that the moment a joint reaches a new (higher) level of flexibility, the associated muscles will have a small region that has never experienced contraction.

For this reason, gains in flexibility should be coupled with strength gains in the extreme ranges of motion to mitigate the chances of injury. Contract-relax stretching may be contraindicated in hypertensive individuals however.

Research conducted by Randy Jensen at the University of North Texas showed an increase of 20mm/hg in systolic and 13mm/hg in diastolic blood pressure when three repetitions of PNF hip flexion were performed.

Interestingly, Jensen reported that ROM increased after one repetition but did not further increase after repeated repetitions. Fitness professionals should therefore monitor gains in ROM after each repetition of contract-relax stretching and discontinue stretching when the ROM reaches a plateau.

Contrast Antagonist-Relax Method: Facilitates an increase in muscle length through a maximum isometric contraction of the antagonist immediately prior to a static stretch of the agonist.

CONTRACT ANTAGONIST-RELAX (CA) METHOD

Very similar to the contract-relax method, CA stretching facilitates an increase in muscle length through a maximum isometric contraction of the antagonist immediately prior to a static stretch of the agonist. Because the antagonist is momentarily fatigued from the isometric exertion, it becomes less able to oppose the lengthening of the agonist.

Due to the inherent similarities to contract-relax stretching, this method may also involve risk to the hypertensive client, and the aforementioned precautions should be strictly observed.

Fascial Stretching: Deep tissue manipulation.

FASCIAL STRETCHING

As mentioned earlier, fascia (the elastic, membranous "sheath" which encases muscles and muscle groups) can bind and constrict the muscles that surround a joint.

Dr. Ida P. Rolf was largely responsible for raising awareness of this phenomenon by developing Structural Integration (or *Rolfing*, as it is commonly known), a method of improving the body's natural alignment with gravity by "releasing" fascial restrictions to efficient, natural movement.

Fascial stretching involves deep tissue manipulation and should only be performed by a competent physical therapist or certified Rolfer.

Although fascial stretching is still a new and evolving practice, it holds great promise for those who wish to achieve a permanent increase in their range of motion.

This all sounds fine, but how do you use it in the real world? It is really quite simple: for optimal performance, you will include dynamic stretching in the warm-up and static stretching in the cooldown.

This warm-up is not a rule but a guideline. Experiment to find what works best for you.

THE WARM-UP

This warm-up and cooldown routine is adopted from Dr. Robert Wolff's *Bodybuilding 201*, with a few minor changes.

These tips are to enhance performance and decrease the chance of injury.

1. Warm up and stretch before every workout—general warm-up, dynamic warm-up, and specific.
2. Start with five to ten minutes on the bike, elliptical, or stair master, or even do a light jog; this is the general warm-up.
3. After performing a five- to fifteen-minute dynamic warm-up, start out with light warm-up sets, and stay with the lighter weights until the body part you are working is fully warmed up.
4. Use good form for each exercise. Performing quality repetitions leads to the development of skill. Use light weights to develop proper form.
5. Immediately stop doing any exercise if you feel any twinge, pain, or abnormal workout discomfort. Remember, this not a license to be a wimp; as you gain experience, you will learn what is good pain and what is bad pain. When in doubt, shut it down!

The warm-up is really important, as it helps raise the core temperature of the body, really gets the blood flowing (helps your muscles perform better and greatly reduces the chance of injury), helps make the muscles elastic, and gets the joints moving, with synovial fluid (think of it like grease for your joints that helps them move easily) lubricating those joints. All of those are great things.

I've found that certain factors will affect not only my workouts and stretching but also my warm-ups. The major variable that can influence the quality of a warm-up is the air temperature. Colder weather is tough on the body, and the colder the weather, the more time you will require to get warmed up for your workout. Conversely, warmer weather is easier on the body, as it takes less time to increase core body temperature.

THE PRE-WORKOUT STRETCH DYNAMIC WARM-UP

1. Finger stretches: Open each hand up and spread the fingers as wide as possible; then close them and do it again and again. Open. Close. Open. Close. 10–20 repetitions.
2. Hand/wrist rotations: Rotate small circles forward and backward 10 times each way.
3. Elbow rotations: Rotate at the elbows in a circular fashion forward and backward 10 times each way.
4. Rotations of the shoulder: Swing the arms in a circular motion forward and backward 10 times each way.
5. Knee-ups: Stand in place and raise one leg up to your waist and then the other. Terrific for warming up not only the knees but also the quads; 10 repetitions each side will suffice.
6. Lunges around the world: Lunge forward, lunge forward at a 45-degree angle, lunge laterally, and then finally lunge backward; do this to each side. Around the world once is really 8 lunges (4 lunges with each leg); 2–3 times will suffice.
7. Standing bodyweight-only calf raises: 20–30 nonstop reps. This really helps stretch and warm up the calves, ankles, and feet.
8. Standing trunk twists with either arm in front

of the body or holding a broomstick behind your neck and twisting from side to side for 30–60 seconds, nonstop.

9. Jumping up and down, in place, for 30–60 seconds.
10. Bodyweight squats: 10 repetitions.
11. Neck circles: Rotate the neck in circular manner to the right and left 5–10 reps.
12. Hamstring kicks: Keeping the legs relatively straight, kick up, alternating legs and increasing height for each kick. Proceed with caution.

Now, it's time for the workout. Always begin each exercise with a "mock" set; go through the exact motions and movement for the exercise you're about to do, but do it without any weights.

The goal is to get the body settled into "the exercise groove" and the mind and body to be in complete synch when the weights are used.

POST-WORKOUT BODY-PART STRETCHING, THE WEIGHT TRAINING STRETCHES

If you don't want to commit yourself to the full-on routine, at least stretch the body parts that have been worked.

STRETCHING ROUTINES

FOR BACK AND LATS

Chin bar/Smith Machine bar hang. It's called the chin bar/Smith machine bar hang, and it works great for stretching the lats. Take an overhand grip either on a chin bar or on the Smith machine bar with the bar racked at the highest position on the machine.

The preferable way is to use a bar that's high enough so that your entire body can hang straight up and down without your feet touching the floor. If this is not possible, then do these with your knees bent and your calves and feet behind you.

The key is to let your arms fully extend and your upper body hang so the lats will be stretched. Hang in this position for at least 20 seconds. If your grip will allow, hang a few seconds longer.

Vertical bar grab. Using one arm at a time, grab hold of a vertical bar on a machine and lean back and hold it in the stretched position for 20–30 seconds. You should feel a stretch in the lats and in the biceps. Repeat for the other side.

Lat pull-down machine. This one is similar to the chin bar hang, only you'll be using a straight bar with stirrup handles at the ends or just a regular straight bar with a wide overhand grip.

Position yourself just as you would if you were doing regular lat pull-downs. This time, once you grab the bar and your arms are fully extended overhead, keep them there for 20–30 seconds. To feel it even more, lean slightly forward and feel the difference.

To make this lat stretch work well, use a heavy weight; I suggest picking a weight that is equal to your bodyweight. If the weight too light, you won't feel it. If it's too heavy, you won't be able to pull the bar down far enough so you can sit down. Body weight seems to work well for this.

FOR CHEST

Pec-dec. This stretch will make use of the pec-dec, but you'll only be using it for support. Position yourself with arms behind and resting against vertical pec-dec pads, just as you would if you were doing the exercise. Only this time, instead of keeping your upper body firm against the back

rest pad, let your upper body come forward—while your arms are immovable against the vertical pec-dec pads—and keep leaning forward until your arms are now behind you and you really feel the chest stretch. Hold your body and your chest in this stretched position for 20–30 seconds.

Vertical bar push. Using one arm at a time, grab hold of a vertical bar on a machine. This time, keep your upper body erect and, with arm fully locked out, turn your upper body away from the opposite arm holding the vertical bar. You should feel this in the pecs. Hold it in the stretched position for 20–30 seconds and then repeat for the other side.

Cable crossover machine. You'll be using the beginning phase of a cable crossover exercise for this stretch. Position your body in the middle of a pulley station. With your left hand, grab the stirrup-style handle connected to the left upper pulley. And with your right hand, grab the stirrup-style handle connected to the right upper pulley. Choose a weight that's roughly 25% of your bodyweight (e.g., if you weigh 200 pounds, use 25 pounds on each of the weight stacks.)

Allow your arms and the cables to fully extend up and out to your sides until the arms are completely extended and you're feeling a great chest stretch. To feel it even more, while your arms are fully extended, move your upper body slightly forward. Hold this stretched position for 20–30 seconds.

FOR TRICEPS

Opposite arm grab. Extend your right arm directly overhead. While keeping your upper arm close to your head, bend your elbow so that your forearms and hand are bent over behind your arm. With your left hand, grab your right hand that's behind your head and gently push down on it. You should really feel it stretch the triceps when you do that. Hold it in the stretched position for 20–30 seconds and then repeat for the other side.

Vertical bar push. On that same vertical machine bar, allow one side of your upper body to lean against it and let that side's triceps lie flat against the bar. Try to place as much of your upper arm as possible firmly against the vertical bar. Bend your elbow so that your forearms and hand are bent over behind the arm. Lean into the vertical bar until you really feel your triceps stretch. Hold it in the stretched position for 20–30 seconds and then repeat for the other side.

Lowered E-Z bar. If you can do the Lying E-Z Bar French Press, then you'll easily be able to this stretch. In fact, that's exactly the exercise you'll use, except instead of lowering the weight behind your head and extending it back up overhead, you'll simply lower the weight and keep it in the lowered position for 20–30 seconds.

The crucial thing to remember is to keep the upper arms in a locked position and the hands lowered as far down as possible to really make the triceps stretch. Hold the weight in this lowered, fully stretched position for 20–30 seconds.

FOR BICEPS

Standing straight-arm twist out. This is quick and simple. Simply stand up straight. Let your arms hang down to your sides and straighten them out completely. Now while they are completely locked out and straight, simply turn your hands (be sure the hands are open and the fingers are pointing downward) so that your palms are facing out and away from your body and the backs of your hands are facing the sides of your body. Hold your hands and arms in this position

for 20–30 seconds immediately after your set in your biceps workout.

Vertical bar push. This is similar to one of the chest stretches you did earlier. The difference is, instead of holding onto the vertical bar (as you did for chest), you'll simply keep your arms straight and place the backs of your hands against the bar so that the palms are facing away from your body. Turning the hand out and away from the body like this will stretch the biceps.

Using one arm at a time, place the back of the hand of your completely straightened arm against the vertical bar on a machine. Keep your upper body erect and, with arm fully locked out and back of the hand against the vertical bar, slowly turn your upper body away from the arm and back of the hand that's pushing against the vertical bar. The more you turn your body away from the bar, the more you should really feel this in the biceps. Hold it in the stretched position for 20–30 seconds and then repeat for the other side.

FOR SHOULDERS AND DELTS

Standing opposite-elbow pull. Here's another easy one that works great on stretching the shoulders. You can either stand or sit for it, too. Take your right arm and bring it across the front of your body toward your left shoulder. As it is coming across the front of you, with the left hand, grab the right arm's elbow and slowly pull it across your body and toward your left side. You will feel a good stretch in the right shoulder muscle area.

You can either hold the stretch for about 10 seconds or do what I like to do: hold it for 2–3 seconds, then release the pull/stretch, do it again for another 2–3 seconds, then release the pull/stretch, and then do it for a third time for a final 2–3 seconds. Do the same thing for the other side, and you've just done a safe, simple, and very effective shoulder stretch.

FOR QUADS

Flat bench kneel. Find a padded flat bench. Kneel down on top of the flat bench so that your legs are together and your glutes and upper body weight are resting on top of your calves, which are together and behind and underneath you.

Keep your upper body in a straight vertical line and slowly allow your upper torso to shift backward until you feel the stretch in your quad and upper thigh. Hold it in this position for 20–30 seconds. The more your upper body leans back toward your feet, the more you'll feel the stretch in the quads. To reduce the stretch, simply come up and forward.

Standing one-leg hold. Stand up straight with your body in a straight vertical line. Bend your knee until calf and foot are behind you. With the same hand as the bent leg (i.e., left hand holding the left foot), grab the top of your foot and hold it until the heel touches your glutes. Keep the bent upper leg in a straight line with your upper body. Hold it in the stretched position for 20–30 seconds and then repeat for the other side.

Bodyweight deep squat bend. Think of how you'd do a regular barbell squat—body upright, head up and looking forward, upper body weight centered over the back of the heels, knees traveling in a straight line over the big toes, feet about shoulder width apart—only you're not going to use any weight—just a good deep knee bend. Lower your body until you reach the bottom position of the knee bend/squat and keep it in the lowered position for 20–30 seconds.

FOR HAMSTRINGS

Forward ankle grab. Keep both legs together and feet pointed straight forward. Allow the upper body to bend forward until the chest comes down to upper-leg level and the head is at knee level. Grab hold of your ankles and, with a gentle but controlled pull, bring your upper body down as far as possible until you really feel a great stretch in your hamstrings. Do not bounce. Simply go as far as you comfortably can, and you'll find your range of motion improving as you include this stretch in your routine on a regular basis.

Stiff-legged dumbbell/barbell deadlift with bottom pause. Do these just as you'd do a regular dumbbell or barbell stiff-legged deadlift, only pause for 2–3 seconds in the bottom position before returning the upper torso to the starting erect position.

Holding the weight with your arms locked out and down against your legs and with your body fully erect, bend the upper torso over until the barbell is lowered as far as possible.

Some people will be able to lower the bar until it touches the top of their feet. Others may only be able to bring the barbell down to shin level. You can bend your knees but only slightly. You want to make sure the hamstrings are fully stretched.

Try not to overly round your back as you lower the weight. Keep your back flexed and tight, as this is not a lat movement. Keep the bar in the lowered position for 20–30 seconds. Keep both legs together and feet pointed straight forward.

How far down should you go? Simply bring your upper body down as far as possible until you really feel a great stretch in your hamstrings. Do not bounce. Go as far as you comfortably can, and you'll find your range of motion improving as you include this stretch in your routine regularly.

Keep in mind that the farther the weights are in front of your body and legs, the *less* you'll feel in the hamstrings. The closer you bring the dumbbells or barbell to the shins and lower legs, the *more* you'll feel it in the hamstrings.

FOR CALVES

Standing lowered heel. This is an easy one. Simply stand on the edge of a platform that's high enough that your heels can come all the way down as far as possible without your heels touching the floor. Keep your body straight and only hold onto something for balance if you need to, but do not take your body weight off the stretched calf muscles. This will really burn, and that's exactly what you want, so keep your powder dry. Hold it in the stretched position for 20–30 seconds.

Leg press toe raise/lower. Place the balls of your feet on the bottom edge of the foot platform. Keep your knees locked. By moving only the ankles, let your feet come back and the platform come down as far as you comfortably can. Hold the feet in this stretched position for 1–2 seconds then—while keeping your knees locked—push the weight back up as far as you can with your feet. Hold the weight in this fully contracted position for 1–2 seconds and repeat. Go for high reps of more than 20 per set.

Leaning against wall. Stand up straight. Place one or both hands against a wall. While keeping your upper body upright, bring your left leg back behind you about 2–3 feet and your entire bottom surface of your left foot must be firmly flat on the floor.

Now, lean forward slightly until you feel a stretch in the left calf. The farther forward your upper

body goes, without moving your left foot, the more you'll feel it in the left calf. Hold for 20–30 seconds and repeat for the other side.

A FEW LAST WORDS

Foam rolling can also be done post workout and on off days. Please refer to Unit 14 on recovery for a full explanation and routine.

Flexibility is not the name of the game in body-building, but you will feel and perform better with adequate flexibility. To be the best, do not neglect any aspect of your training.

TOPICS COVERED IN THIS UNIT

- Assessments for Bodybuilders
- Benefits of Testing
- Testing Procedures
- Testing Problems and Concerns
  - Validity
  - Reliability
  - Objectivity
  - Safety
- Testing for Limit Strength
- Comparing Strength Across All Bodyweights
- Body Composition Testing
  - How to Use Skinfold Calipers
  - Calculating Percent of Fat Using Density Formulas
- A Few Last Words

UNIT 8

TESTING AND EVALUATION

ASSESSMENTS FOR BODYBUILDERS

Testing an athlete for performance enhancement is an extremely common practice in sports such as football, but it is not nearly as common in bodybuilding.

Though "big numbers" do not offer a one-to-one correlation of how successful a bodybuilder will be, testing provides bodybuilders and trainers alike with valuable information on several levels.

It is all too common today for many bodybuilders' trainers to go by "feel" alone. Having a good feel on the level of progress is important; however, bodybuilders will be judged on how they look on stage. As a bodybuilder advances, it is important that you not only pay attention to your intuition and your instincts regarding elements of training, but also to the results of the performance tests you conduct.

BENEFITS OF TESTING

Testing yields several benefits:

1. Testing provides the trainer with an evaluation of the athlete's compliance. Once the trainer has validated a program's effectiveness, testing will determine whether an individual athlete has in general adhered to the program. (Of course, there are always exceptions.) It is a trainer's job to know who is following the program and who is not.
2. Testing provides the trainer and bodybuilder with information on individual strengths and weaknesses. A one-size-fits-all training approach does not apply to bodybuilding programs, so testing will provide you with information on some changes that need to be made regarding the current training program; this will aid in identifying performance needs and reduce possible health risks.
3. Different athletes will have different needs, and they should be addressed accordingly. Just think, if you can easily do leg extensions for reps with 150 pounds but struggle to do leg curls of 50 pounds, you are setting yourself up for not only asymmetrical imbalances but also a greatly enhanced chance of injury.
4. Testing is motivational. As a trainer, after a successful evaluation of performance, I can tell an athlete definitively, "You have gotten stronger; your arms have grown by half an inch!" This will motivate my athlete and spark great enthusiasm. Even my saying, "Your bench press improved by 10%" can generate excitement. Being your best on stage is the ultimate goal; however, testing is a goal itself and often gives bodybuilders even more reason to train.
5. Testing allows the trainer to seek quantitative data on whether the program he/she prescribed is effectively working. Testing periodically will allow you to track the rate at which your client is progressing. If progress stagnates, this may be a sign that variables in your programming should be changed to stimulate progress.

Whatever the reason for testing and evaluation, above all, it must serve a purpose. There must be a reason for the test. In addition, it must be properly planned, and it must provide useful data. Testing for the sake of testing (often a result of the athlete or coach's self-gratification) is purposeless and often dangerous. It is commonly recommended that testing can be done as often as once per month and as infrequently as three times per year. The type of test will determine the frequency with which it is conducted. A body fat test or a weigh-in does not adversely affect the athlete if done too often, at least not physically. However, maxing out on the squat once per week would be a terrible idea.

TESTING PROCEDURES

When bodybuilders are undergoing testing, proper planning is needed for safe and successful testing. Several questions must be answered before testing can commence.

Will testing be conducted on just you or on several athletes? Testing one individual at a time is optimal; you won't be rushed during warm-up, and only one supervisor is needed.

Who will supervise the test? Ideally, a certified trainer with knowledge of bodybuilding and serious strength training will supervise all testing. However, if testing multiple bodybuilders is necessary, others who are qualified will need to assist the trainer with the procedures.

Regardless of the instructor's qualification level for testing, once other administrators are brought on board to help test a group of bodybuilders, explicit instructions must be given to these administrators.

If squats are being tested and one instructor is making bodybuilders squat to legal powerlifting depth below parallel, another is doing half squats, and still another has an Olympic lifting background and makes participants literally bottom out each squat, inaccurate, conflicting data will be the best-case scenario. The worst case is serious injury because the bodybuilder is performing a completely new movement with no room for any sort of learning curve—with 100% intensity. Not good!

Even if these administrators have explicit instructions, one must also realize that recruiting less experienced testing administrators increases the likelihood that test validity will be compromised.

With most athletes and trainers owning smartphones, there is no excuse not to video the testing sessions. Not only can this ensure validity, but also coaches and athletes alike will have a chance to evaluate technique used when the athletes perform exercises with true maximum effort.

How will the tests be conducted? Before testing is done, some guidelines must be established on how the test will be conducted. For example, if you are testing a bench press max, you must make decide beforehand whether it will include a pause at the bottom or whether bouncing will disqualify the lift.

Set standards ahead of time and do not waiver. Testing is for evaluation, not self-gratification. If the lift is disqualified, if the bodybuilder's hips rise off the bench, enforce the rules.

When you find yourself in gray areas regarding what is excessive, you open Pandora's Box. As they say, "The road to hell is paved with good intentions," so stick to your guns. It is even important to set rules for variable such as how many attempts are allowed.

I must again emphasize the importance that test administrators, as well as test takers, understand the procedures. Pre- and posttests must adhere to the same standards and procedures.

It is all too common for a coach to initially test the athlete on a full squat, and then the retest will be a half squat. This is done to inflate the results, but one must remember this is just self-gratification of the coach's ego and in no way reflects true quantitative data.

How will the bodybuilders prepare for the test? Remember that testing for limit strength is often a one-repetition-maximum attempt requiring an all-out effort. This requires the bodybuilder to prepare for a test in the same manner a football player does for a game or practice or even a powerlifter for a meet. Proper warm-up,

psychological techniques, and nutritional/supplemental support should all be included.

If several tests will be given, what sequence will the tests be in? It is not uncommon in sports such as football or basketball for coaches to use the squat, power clean, vertical jump, sprint test, and series of sprints for conditioning testing. Clearly, if a coach tried to test them all on the same day, the performances on the later tests would suffer.

For example, an athlete's vertical jump will be affected after a heavy squat attempt. Good strength and conditioning coaches in the NFL and NCAA carefully plan and scrutinize the sequence when testing athletes. Coaches must do this with an even sharper eagle eye. Here is why.

In college football, you can recruit great talent and win because of talent; many poor strength coaches succeed because of the talent their programs are blessed with—just like there are good strength coaches at programs that have less athletic talent.

Bodybuilding, of course, requires great genetics to reach the top, but talent and genetics are not the only factors determining success.

I have yet to meet the person who cannot build an above-average physique following sound training combined with nutritional and supplemental protocols. I have known plenty of basketball players who work hard at the high school junior varsity level, yet because of genetic limitations are unable to receive regular playing time.

You are the master of your own destiny, more so in the iron game; so pay attention to little details like the sequence for big results. Don't do a maximum push-up test prior to a one-repetition bench press max; common sense applies. You should do power tests (rarely needed by bodybuilders) before strength tests and strength tests before endurance tests.

How will the data be recorded and analyzed? This includes preparing proper forms for recording (do not try to remember scores—write them down) and determining which methods will be used to interpret the data.

Determining the relationships among scores (as academics try to do in a number of ways) involves running a series of statistical analysis equations. If you are simply trying to note improvement in one particular test, you must decide what specifically qualifies as a significant improvement.

TESTING PROBLEMS AND CONCERNS

After you've considered the above concerns (and you've written them down in a careful plan), other problems and concerns remain. Testing holds many advantages, but it also involves pitfalls. Here are a few:

VALIDITY

Is the test valid? Is it a suitable measure of what is intended to be measured? Obviously, a one-rep max in the bench press does not measure leg strength. However, many popular tests are invalid for the athletic attributes for which the coach believes he or she is testing.

For example, using 225 pounds for reps in the bench press does measure strength. But what kind of strength is being measured? If the athlete can bench press 450 pounds, then it is certainly not limit strength that is being measured!

It is comical that the 225-pounds bench press trial for 350-plus-pound linemen is a staple strength test in NFL combines. A consideration of this

testing protocol shows that it may need to change to become valid. Just because a multibillion-dollar entity like the NFL refuses to change its dated testing procedures does not mean you have to follow suit.

RELIABILITY

Testing must be consistent. In other words, if you repeat the test again and again under the same conditions, will you see the same score? If there is no consistency in measurements, a "measurement error" has occurred. How many times has someone started a workout program, measured his arms accurately at the commencement of the program, and then reported gains a month later with a more "friendly" measurement procedure?

Validity: The extent to which a test accurately measures what it is supposed to measure.

Reliability: The degree to which a test is consistent and stable in measuring what it is intended to measure.

Objectivity: A test that is objective measures without reference to outside influences.

Furthermore, the measurement needs to be taken at the same time of day; measuring arms "cold" in the morning, is different from measuring them pumped after a high-volume workout that was preceded with a pre-workout supplement that encourages a "pump."

The following list describes possible reasons for inaccurate data, with a practical example:

- Those who measured the performance(s) did not take accurate measurements. (See arm example above.)
- The athlete being tested did not perform consistently. (Could range from illness to shoddy equipment to just an "off" day.)
- The instrument used during testing failed to produce an accurate measurement (e.g., if testing maximum isometric force and the dynamometer does not register a score).
- Standard procedures were not followed. (The first test was a full squat for a one-repetition max, but the next test was a half squat for a one-repetition max.)

OBJECTIVITY

Objectivity pertains to whether clear instructions have been given prior to the test. If a test has a high level of objectivity, several testers can administer the same test on the same athlete and obtain nearly the same results.

Validity, reliability, and objectivity are all closely related. If there is no objectivity during the testing process, the test cannot be considered reliable. If a test is unreliable, it clearly is invalid.

However, a test can be reliable and objective and still be invalid. As in the above example, you can have high levels of validity and objectivity using

225 pounds for reps in the bench press (the repetitions are all according to directions, and all testers counted the same number of repetitions.) You do not however have a measure of limit strength, as the test reveals little about how much weight the specific lineman can bench press one time.

SAFETY

To recap from earlier, testing is often an act of maximum performance. However, you must remember that you will not win the Olympia or even the "hot body" contest at the local honky tonk bar during a test! Although there are several reasons to administer a test, it should never result in an injury, nor should it expose you or your athletes to that possibility.

Here are some tips on how to make your testing safe:

- Be prepared for the test. Athletes should always be properly warmed up and focused on the task at hand. Proper nutrition and supplementation needs to be intact. Remember, wear the proper attire according to the test involved: If you are bench-pressing, wear a T-shirt; otherwise, if you are sweating, you might slide all over the bench press; use common sense.
- Clear all unnecessary equipment and other objects from the testing area. Only the necessary equipment should be present in the testing area. Gym bags, water bottles, loose plates and collars, clipboards, towels, nor any other object should ever find its way under the athlete's foot.
- Keep a watchful eye. Many times accidents happen because conditions that may cause an injury are overlooked (e.g., collars not secured on a bar or wet surfaces on the gym floor). Furthermore, a "watchful eye" also means your trainer will realize when you should not continue during a test or when you should not engage in testing at all.
- Side note: Are you noticing that the safety precautions suggested here are the same ones that should be followed during any kind of training?
- Allow yourself a proper cooldown. Do not assume that once the test is over, you are clear of danger. If you have not allowed time for a suitable cooldown and you pull a hamstring while walking home after a squat max, the injury can be considered test related. In any case, you will be out of commission for a while.
- Make sure your trainer's assistants/helpers are following proper testing and safety procedures. It will do your trainer no good to follow proper procedures if the assistants aren't doing so, too.
- Use common sense! It may seem that these guidelines follow logic. However, injuries during testing do occur, and there is no excuse for it. If the above guidelines are logical and follow common sense, why do injuries happen? Common sense isn't used. Plain and simple.

TESTING FOR LIMIT STRENGTH

Your limit strength, or how much force you can exert for an all-out effort, is obviously going to be different for each muscle or movement. Furthermore, differences in strength exist between men and women of different ages and bodyweights. Always remember that as a bodybuilder, limit strength is your foundation.

Your relative strength is your limit-strength-to-bodyweight ratio, which is extremely important. You should remember that the heavier you are, the lower your relative strength level will be. That's because your ratio of fat to muscle is poor. You can't flex fat. For a quick recap, muscle, not fat, moves weight.

Limit strength is tested by lifting maximal weights. A max-effort movement is classified generally as one to three repetitions with greater than 90% of an athlete's one-repetition max.

The most effective measurement of limit strength is powerlifting. In all other sports, limit strength is a component and, as an athlete advances and becomes stronger, decreasing amounts of time are devoted to building his or her limit-strength base. Powerlifting is limit strength and relative strength; you lift as much weight as possible for a one-repetition max, there is no time limit to lift the weight, and you are compared with competitors within your weight class.

The best way to test limit strength is with a one-repetition max in a core movement. Many people question the safety of this practice, but look at it logically: form breaks down sometimes with heavy weight, but it also does so with fatigue.

Doing a one-repetition max, you risk some form breakdown. Doing a repetition max with 85%–90% of your one-repetition max, you are still lifting heavy weight, but fatigue will rear its ugly head; this is a sure-fire way to have form breakdown.

I have seen more injuries on the last rep of a squat or deadlift when five or more repetitions are performed than on heavy singles. The mindset for a heavy single is just that—to perform a heavy single. For max reps, there is no true mindset besides one more and push through the pain. Technique from a psychological standpoint is a focus when maxing; it seems to be put on the back burner for rep maxes.

Obviously, the easiest and most reliable method for determining limit strength is to perform one repetition for each exercise. However, some may prefer to estimate their one-rep max by performing a multiple-repetition test.

High school strength coaches are notorious for using special "formulas" to estimate their athletes' one-rep maximums. I have had high school clients be off in their estimated one-rep maxes to their actual ones by over 65 pounds in the bench press; we are talking about athletes in the 300-pound bench range, so that is a greater than a 20% margin of error. With that kind of inaccuracy, it might be easier for coaches just to eyeball their athletes and make a guess.

Formulas do not account for muscle fiber makeup, training history, training methods being used, or level of psychological arousal. If it is unsafe to lift your max in a core movement, it is likely unsafe to lift 90% of your one-rep max for a maximum number of reps. The total is unknown, and fatigue will potentially show its face, making one more enemy to proper technique.

As will be discussed in the unit on periodization, the number of repetitions an individual with a higher content of *type I* muscle fiber can do with 80% of his or her one-repetition max is much different from what an individual with a higher content of *type II* muscle fiber can do with 80% of his or her one-repetition max.

Thus the reason there is no universal formula for testing one-repetition maxes: at best, they are an educated guess, and at worst, they don't provide any reliable information whatsoever.

When working with clients and athletes with chronic injuries, you must be very careful conducting tests for limit strength. In this case, other tests that assess body fat and muscle size gains may be more appropriate. All in all, a chronic injury means you will probably miss out on certain things, and it is probably in the trainer's best interest to avoid having someone with a chronic injury perform maximal testing for health and liability purposes.

COMPARING STRENGTH ACROSS ALL BODYWEIGHTS

Your limit strength is obviously going to be different for each muscle or movement. A group of three exercises adequately tests your limit strength. You needn't go through several exercises, testing each muscle's force capabilities.

These three exercises are the squat, the deadlift, and the bench press. They are collectively called the powerlifts, and they compose the sport of "powerlifting."

In powerlifting, we are able to compare athletes of different weight divisions with each other by applying a simple equation to their bodyweight and the total of the three lifts.

This formula is called the **Wilks Formula.**For ease of application, the formula is presented in abbreviated form.

To use the Wilks Formula, find your bodyweight in kilograms. Multiply your total amount of weight lifted by the number to the right of your bodyweight.

For example:

Lifter A (Male) totals 590 Kg at a bodyweight of 75 Kg.
590 kg x 0.71256 = 420.4104

Lifter B (Male) totals 575 Kg at a bodyweight of 68 Kg.
575 Kg x 0.766497 = 440.73577

Despite a lower total, Lifter B is the stronger lifter. Simple interpolation will allow you to accurately estimate the coefficient to use for lifters whose weight is not a whole number.

For example, if Lifter A weighs 75.5 kilograms, split the difference between the coefficients for 75 kg and 76 kg, and you'll get a coefficient of .709322.

Wilks Formula: An equation to compare athletes of different weight divisions with each other.

Body Composition: The percentages of fat, bone, water and muscle in human bodies.

Skinfold Test: A clinical method used to estimate a person's percentage of body fat, in which a pinch of skin from one of seven particular areas—biceps, triceps, subscapular, suprailiac, abdomen, thigh, and calf—is measured by a caliper.

Bioelectrical impedance: Measures the resistance of body tissues to the flow of a small, harmless electrical signal.

DEXA Scan: Uses a whole-body scanner along with two different low-dose X-rays that read soft tissue mass and bone mass.

Hydrostatic Weighing: Applies Archimedes' principle that an object immersed in a fluid loses the amount of weight equivalent to the weight of the fluid displaced by the object's volume. Because fat is less dense than muscle is, fatter individuals have a lower total body density than their leaner counterparts do.

BODY COMPOSITION TESTING

Practical methods of assessing body composition, such as **skinfold**s, **bioelectrical impedance**, **DEXA scans**, air displacement plethysmography, and **hydrostatic weighing** are based on the two-component model of body composition (fat and fat-free weight). Further dividing body fat into essential fat and storage fat leads to the search for the best way to measure storage fat.

The search and research for the most valid, most practical, and most affordable method of body composition testing continues. You should know that most methods carry a 3%–4% error factor in their prediction of body fat. The higher the skill of the person taking the measurements, the lower the error rate.

The three most common measurement techniques are hydrostatic weighing, bioelectrical impedance, and skinfold measurement.

Considered the standard, hydrostatic weighing applies Archimedes' principle that an object immersed in a fluid loses the amount of weight equivalent to the weight of the fluid displaced by the object's volume. Because fat is less dense than muscle is, fatter individuals have a lower total body density than their leaner counterparts do.

Although for years hydrostatic weighing was considered the most accurate, the DEXA scan is now believed by many to be the gold standard. DEXA scans and hydrostatic weighing's greatest disadvantage are their inaccessibility to most gym rats, unless these methods are in a medical or university setting.

Bioelectrical impedance is based on the fact that the body contains intracellular and extracellular fluids capable of electrical conduction. Because fat-free bodyweight contains much of the body's water and electrolytes, it is a better conductor of the electrical current than fat is, which contains very little water. This technique is essentially an index of total body water from which body fat is estimated. If you retain more water than most, you will read higher than you truly are.

Bioelectrical impedance's popularity has increased over the last few years because it is painless, quick, and easy to perform. One drawback is the initial investment cost of the machine, which can run upward of $3,500. And although bioelectrical impedance is OK for most people, it does tend to overestimate body fat in very lean people and underestimate body fat in obese people.

DEXA scan uses a whole-body scanner along with two different low-dose X-rays that read soft tissue mass and bone mass. This procedure usually takes about 15 minutes. It is painless. This is an expensive assessment, usually around $250.

The skinfold method of determining body fat is practical, affordable, and easy to perform, with practice. This method is done with calipers. These calipers measure the thickness of the outer layer of fat on your body. The measurements are then automatically "plugged" into regression equations to determine percentage of body fat.

Once you have measured the skinfolds at the sites indicated, you can easily compute your percent body fat using a table of norms. There's no math for you to do with these techniques. The skinfold method is based on the fact that the distribution of subcutaneous fat and internal fat is similar for all individuals. This assumption is not without error however. Research has shown that older people of the same body density and gender have proportionately less subcutaneous fat than do their younger counterparts. There is considerable variation in terms of age, gender, and degree of fatness. The skinfold equations, however, have been developed to estimate the body fat of men and women varying greatly in age (from 10 to 61 years) and body fatness (from 4% to 44%).

HOW TO USE SKINFOLD CALIPERS

Measuring body fat with calipers takes practice. When measuring most sites, you should hold the calipers vertically or (as is the case with subscapular and suprailliac measurements) at a slight angle to conform to the natural fold of the skin.

Firmly pinch the skinfold with your thumb and forefinger, being sure to grasp only the skin and fat directly beneath the skin. Then, while holding the fold of fat away from the underlying muscle, place the calipers over the fat fold in such a way that the fat fold thickness is within

the jaws of the calipers, and read the measurement. Perform the measurement a few times for practice before you trust your judgment. It takes practice to ensure accuracy.

Some notes on taking skinfold measurements:

- Take a minimum of two measurements at each site, doing so in rotational order rather than taking consecutive readings at the same site. If your values differ by more than one millimeter, take an additional measurement.
- When you take skinfold measurements, skin should be dry and free of oils and lotions. Try not to take measurements immediately after exercise, because the body fluid shifts to the skin.
- The more you practice, the better you will become at measuring skinfolds accurately. Comparing your results with those of a skilled trainer can be of great benefit when learning these skills.

1. Triceps: Measure at the bottom of the inside (long head) of the triceps. Pull the skinfold in a vertical direction.

2. Subscapular: Locate the middle of the scapula (shoulder blade) and measure about one inch from the spine. Pull the skinfold in a vertical direction.

3. Pectoral: Measure about one inch below the collar bone and two to three inches out from the inside edge of the pectoral muscle. *Be sure to stay on the pectoralis and* ***avoid breast tissue*** *if you are measuring a female.* Pull the skinfold in a vertical direction.

4. Mid-axillary: Measure the fold in a horizontal line at a level with the bottom of the sternum. Pull the skinfold in a vertical direction.

Figure 8.1a Skinfold sites and descriptions: triceps, subscapular, pectoral, and mid-axillary

- A side note: in severely obese individuals (who have greater than 45% body fat), it is impossible to measure skinfold thickness accurately. An alternative in this situation is to use girth measurements, a less embarrassing practice.

CALCULATING PERCENT OF FAT USING DENSITY FORMULAS

Numerous investigations have produced various equations for use on the general population as well as on specific subgroups, such as athletes. However, these equations have high correlations only with the populations upon which they were developed; many of these equations are not universal. However, a set of prediction equations exists that is generalized for males and females. Table 8.1 provides a step-by-step guide for the body fat calculation that incorporates two equations: the Jackson and Pollock body density equation and the Brozek body fat equation.

5. Abdominal: Measure about one inch to the left of and one inch down from the navel (belly button). Pull the skinfold in a vertical direction.

6. Suprailiac: Measure about halfway between the navel and the top of the hipbone. *This should be at or near the area where the oblique and abdominals meet.* Pull the skinfold in a horizontal direction.

7. Quadriceps: Measure in the middle of the quadriceps. *If the area is too tight, you may need to go up one to two inches.* Pull the skinfold in a vertical direction.

8. Calf: Measure the middle of the inside head. Pull the skinfold in a vertical direction.

Figure 8.1b Skinfold sites and descriptions: abdominal, suprailiac, quadriceps, and calf

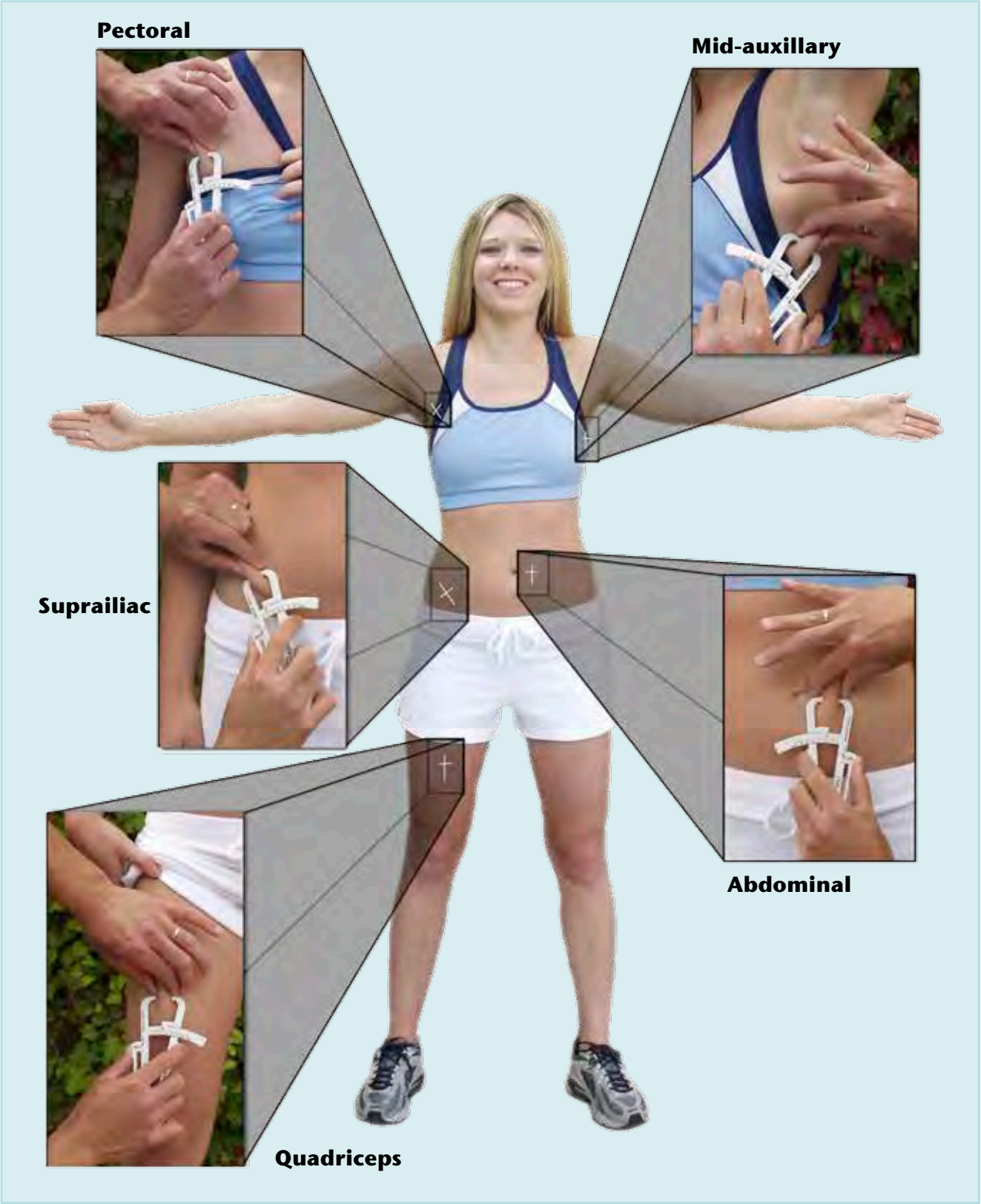


Figure 8.2a Skinfold sites: anterior (front) view

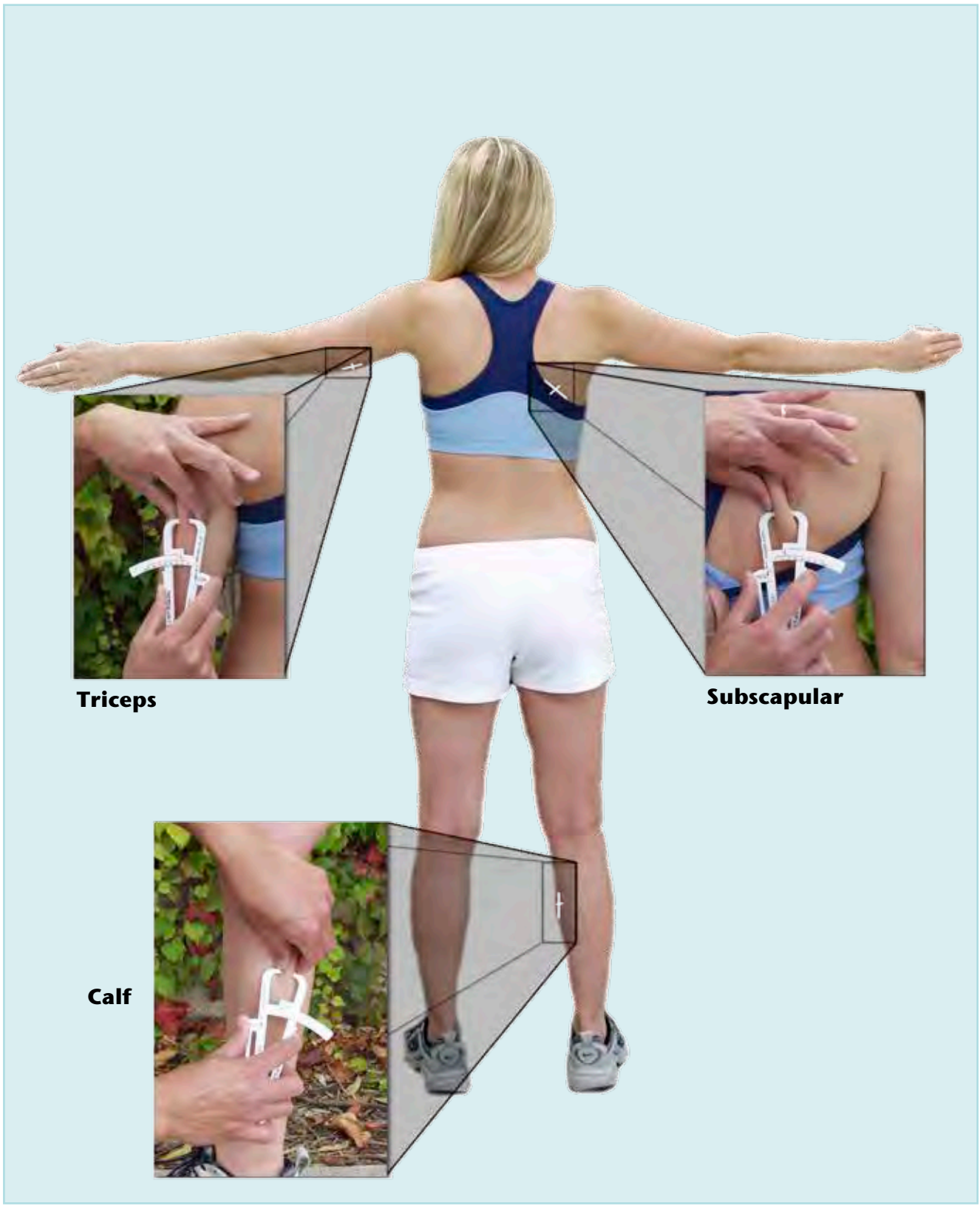


Figure 8.2b Skinfold sites: posterior (back) view

Table 8.1a: Calculating Body Fat Using Skinfolds: Males

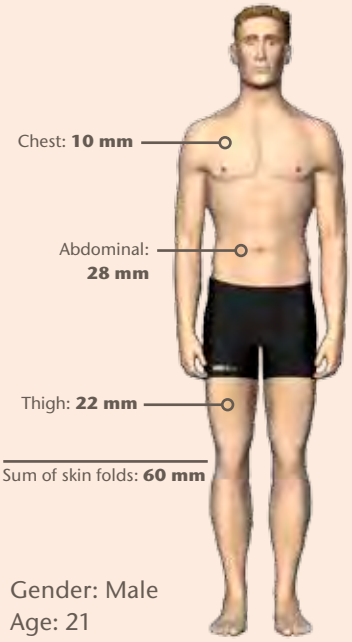
STEP ONE: Take skinfold measurements from the chest, abdominal, and thigh sites. Add the measurements together to find the sum of skinfolds.

Sum of skinfolds for male clients:

Chest measurement
+ Abdominal measurement
+ Thigh measurement
= Sum of Skinfolds

Example:

Chest:	10
Abdominals:	+28
Thigh:	+22
Sum of Skinfolds:	= 60



Gender: Male
Age: 21
Weight: 200 lbs
Chest measurement: 10
Abdominal measurement: 28
Thigh measurement: 22

STEP TWO: Take the sum of the skinfolds (60 in this example) and the age of the individual (21 in this example) and plug them into the Jackson and Pollock equation (below).

Math tip: Do all work in parenthesis first. Next, do all division and multiplication. Finally, calculate all remaining addition and subtraction.

Jackson and Pollock body density equation:

START HERE

1.10938 –
(0.0008267 × sum of skinfolds) ◄ (A)
+ (0.0000016 × [sum of skinfolds × sum of skinfolds]) ◄ (B)
– (0.0002574 × age) ◄ (C)
= body density (D)

Equation breakdown:

(A) 0.0008267 × sum of skinfolds
(B) 0.0000016 × (sum of skinfolds × sum of skinfolds)
(C) 0.0002574 × age

1.10938 –
_____
+ _____
– _____

START HERE Calculate (A), (B), and (C) first.

(D) 1.10938 – A + B – C = body density

= _____ (body density)

Example:

(A) 0.0008267 × 60
(B) 0.0000016 × (60 × 60)
(C) 0.0002574 × 21

1.10938 –
0.049602
+ 0.00576
– 0.0054054

START HERE Calculate (A), (B), and (C) first.

(D) 1.10938 – 0.049602 + 0.00576 – 0.0054054

= 1.0601326 (body density)

STEP THREE: Once you determine the body density (1.0601326 in t his example), plug it into the Brozek body fat equation (below).

Brozek body fat equation: **([4.570 ÷ body density] – 4.142) × 100 = body fat percentage (BF%)**

Example:

([4.570 ÷ 1.0601326 – 4.142) × 100 = 16.9% body fat

Table 8.1b: Calculating Body Fat Using Skinfolds: Females

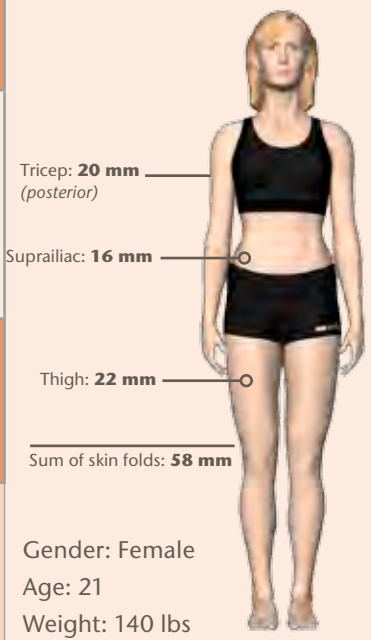
STEP ONE: Take skinfold measurements from the tricep, suprailiac, and thigh sites. Add the measurements together to find the sum of skinfolds.

Sum of skinfolds for female clients:

Tricep measurement
\+ Suprailiac measurement
\+ Thigh measurement
= Sum of Skinfolds

Example:

Tricep:	20
Suprailiac:	+16
Thigh:	+22
Sum of Skinfolds:	= 58



Gender: Female
Age: 21
Weight: 140 lbs
Tricep measurement: 20
Suprailiac measurement: 16
Thigh measurement: 22

STEP TWO: Take the sum of the skinfolds (58 in this example) and the age of the individual (21 in this example) and plug them into the Jackson and Pollock equation (below).

Math tip: Do all work in parenthesis first. Next, do all division and multiplication. Finally, calculate all remaining addition and subtraction.

Jackson and Pollock body density equation:

START HERE

1.0994921 –
(0.0009929 x sum of skinfolds) (A)
\+ (0.0000023 x [sum of skinfolds x sum of skinfolds]) (B)
– (0.0001392 x age) (C)
= body density (D)

Equation breakdown:

(A) 0.0009929 × sum of skinfolds
(B) 0.0000023 × (sum of skinfolds × sum of skinfolds)
(C) 0.0001392 × age
(D) 1.0994921 – A + B – C = body density

1.0994921 –
\+ _____
– _____
= _____ (body density)

START HERE Calculate (A), (B), and (C) first.

Example:

(A) 0.0009929 × 58
(B) 0.0000023 × (58 × 58)
(C) 0.0001392 × 21
(D) 1.0994921 – 0.0575882 + 0.0077372 – 0.0029232

1.10938 –
0.0575882
\+ 0.0077372
– 0.0029232
= 1.0467179 (body density)

START HERE Calculate (A), (B), and (C) first.

STEP THREE: Once you determine the body density (1.0467179 in t his example), plug it into the Brozek body fat equation (below).

Brozek body fat equation: **([4.570 ÷ body density] – 4.142) × 100 = body fat percentage (BF%)**

Example:

([4.570 ÷ 1.0467179] – 4.142) × 100 = 22.4% body fat

Table 8.2a: Percent Fat Estimates for Men and Women*

	Males (Age in Years)				Females (Age in Years)			
Skinfolds	**17-29**	**30-39**	**40-49**	**50+**	**16-29**	**30-39**	**40-49**	**50+**
15	4.8				10.5			
20	8.1	12.2	12.2	12.6	14.1	17.0	19.8	21.4
25	10.5	14.2	15.0	15.6	16.8	19.4	22.2	24.0
30	12.9	16.2	17.7	18.6	19.5	21.8	24.5	26.6
35	14.7	17.7	18.6	20.8	21.5	23.7	26.4	28.5
40	16.4	19.2	21.4	22.9	23.4	25.5	28.2	30.3
45	17.7	20.4	23.0	24.7	25.0	26.9	29.6	31.9
50	19.0	21.5	24.6	26.5	26.5	28.2	31.0	33.4
55	20.1	22.5	25.9	27.9	27.8	29.4	32.1	34.6
60	21.2	23.5	27.1	29.2	29.1	30.6	33.2	35.7
65	22.2	24.3	28.2	30.4	30.2	31.6	34.1	36.7
70	23.1	25.1	29.3	31.6	31.2	32.5	35.0	37.7
75	24.0	25.9	30.3	32.7	32.2	33.4	35.9	38.7
80	24.8	26.6	31.2	33.8	33.1	34.3	36.7	39.6
85	25.5	27.2	32.1	34.8	34.0	35.1	37.5	40.4
90	26.2	27.8	33.0	35.8	34.8	35.8	38.3	41.2
95	26.9	28.4	33.7	36.6	35.6	36.5	39.0	41.9
100	27.6	29.0	34.4	37.4	36.4	37.2	39.7	42.6
105	28.2	19.6	35.1	38.2	37.1	37.9	40.4	43.3
110	28.8	30.1	35.8	39.0	37.8	38.6	41.0	43.9
115	29.4	30.6	36.4	39.7	38.4	39.1	41.5	44.5
120	30.0	31.1	37.0	40.4	39.0	39.6	42.0	45.1
125	30.5	31.5	37.6	41.1	39.6	40.1	42.5	45.7
130	31.0	31.9	38.2	42.8	40.2	40.6	43.0	46.2
135	31.5	32.3	38.7	42.4	40.8	41.1	43.5	46.7
140	32.0	32.7	39.2	43.0	41.3	41.6	44.0	47.2
145	32.5	33.1	39.7	43.6	41.8	42.1	44.5	47.7
150	32.9	33.5	40.2	44.1	42.3	42.6	45.0	48.2
155	33.3	33.9	40.2	44.6	42.8	43.1	45.4	48.7
160	33.7	34.3	41.2	45.1	43.3	43.6	45.8	49.2
165	34.1	34.6	41.6	45.6	43.7	44.0	46.2	49.6
170	34.5	34.8	42.0	46.1	44.1	44.4	46.6	50.0
175	34.9					44.8	47.0	50.4
180	35.3					45.2	47.4	50.8
185	35.6					45.6	47.8	51.2
190	35.9					45.9	48.2	51.6
195						46.2	48.5	52.0
200						46.5	48.8	52.4
205							49.1	52.7
210							49.4	53.0

Body fat from total body density and its estimation from skinfold thickness. Measurements on 481 men and women aged from 16 to 72 years. *British Journal of Nutrition* Vol. 32:77-97. The equivalent fat content as a percentage of bodyweight for a range of values for the sum of four skinfolds (biceps, triceps, subscapular, and suprailiac) of males and females of different ages. Percent fat calculated by the formula by Siri30. Percent fat = [(4.95/BC)-4.5] x100 where BD = body density. In two-thirds of the instances the error was within 3.5% of the body-weight as fat for women and 5% for men. "Percent Fat Estimates" Clark, Hall, Wilson (1987)

Table 8.2b: Percent Fat Estimates for Women (Sum of Triceps, Suprailiac, & Thigh Skinfolds*)									
Sum of Skinfolds	Age								
	Under 22	23-27	28-32	33-37	38-42	43-47	48-52	53-57	Over 58
23-25	9.7	9.9	10.2	10.4	10.7	10.9	11.2	11.4	11.7
26-28	11.0	11.2	11.5	11.7	12.0	12.3	12.5	12.7	13.0
29-31	12.3	12.5	12.8	13.0	13.3	13.5	13.8	14.0	14.3
32-34	13.6	13.8	14.0	12.3	14.5	14.8	15.0	15.3	15.5
35-37	14.8	15.0	15.3	15.5	15.8	16.0	16.3	15.5	16.8
38-40	16.0	16.3	16.5	16.7	17.0	17.2	17.5	17.7	18.0
41-43	17.2	17.4	17.7	17.9	18.2	18.4	18.7	18.9	19.2
44-46	18.3	18.6	18.8	19.1	19.3	19.6	19.8	20.1	20.3
47-49	19.5	19.7	20.0	20.2	20.5	20.7	21.0	21.2	21.5
50-52	20.6	20.8	21.1	21.3	21.6	21.8	22.1	22.3	22.6
53-55	21.7	21.9	22.1	22.4	22.6	22.9	23.1	23.4	23.6
56-58	22.7	23.0	23.2	23.4	23.7	23.9	24.2	24.4	24.7
59-61	23.7	24.0	24.2	24.5	24.7	25.0	25.2	25.5	25.7
62-64	24.7	25.0	25.2	25.5	25.7	26.0	26.7	26.4	26.7
65-67	25.7	25.9	26.2	26.4	26.7	26.9	27.2	27.4	27.7
68-70	26.6	26.9	27.1	27.4	27.6	27.9	28.1	28.4	28.6
71-73	27.5	27.8	28.0	28.3	28.5	28.8	29.0	29.3	29.5
74-76	28.4	28.7	28.9	29.2	29.4	18.7	29.9	30.2	30.4
77-79	29.3	29.5	29.8	30.0	30.3	30.5	30.8	31.0	31.3
80-82	30.1	30.4	30.6	30.9	31.1	31.4	31.6	31.9	32.1
83-85	30.9	31.2	31.4	31.7	31.9	32.2	32.4	32.7	32.9
86-88	31.7	32.0	32.2	32.5	32.7	32.9	33.2	33.4	33.7
89-91	32.5	32.7	33.0	33.2	33.5	33.7	33.9	34.2	34.4
92-94	33.2	33.4	33.7	33.9	34.2	34.4	34.7	34.9	35.2
95-97	33.9	34.1	34.4	34.6	34.9	35.1	35.4	35.6	35.9
98-100	34.6	34.8	35.1	35.3	35.5	35.8	36.0	36.3	36.5
101-103	35.3	35.4	35.7	35.9	36.2	36.4	36.7	36.9	37.2
104-106	35.8	36.1	36.3	36.3	36.8	37.1	37.3	37.5	37.8
107-109	36.4	36.7	36.9	37.1	37.4	37.6	37.9	38.1	38.4
110-112	37.0	37.2	37.5	37.7	38.0	38.2	38.5	38.7	38.9
113-115	37.5	37.8	38.0	38.2	38.5	38.7	39.0	39.2	39.5
116-118	38.0	38.3	38.5	38.8	39.0	39.3	39.5	39.7	40.0
119-121	38.5	38.7	39.0	39.2	39.5	39.7	40.0	40.2	40.5
122-124	39.0	39.2	39.4	39.7	39.9	40.2	40.4	40.7	40.9
125-127	39.4	39.6	39.9	40.1	40.4	40.6	40.9	41.1	41.4
128-130	39.8	40.0	40.3	40.5	40.8	41.0	41.3	41.5	41.8
*Percent fat calculated by the formula by Siri30. Percent fat = [(4.95/BD)-4.5]x100 where BD = body density.									

Table 8.2c: Percent Fat Estimates for Men (Sum of Chest, Abdominal, & Thigh Skin Folds*)									
Sum of Skinfolds	Age								
	Under 22	23-27	28-32	33-37	38-42	43-47	48-52	53-57	Over 58
8-10	1.3	1.8	2.3	2.9	3.4	3.9	4.5	5.0	5.5
11-13	2.2	2.8	3.3	3.9	4.4	4.9	5.5	6.0	6.5
14-16	3.2	3.8	4.3	4.8	5.4	5.9	6.4	7.0	7.5
17-19	4.2	4.7	5.3	5.8	6.3	6.9	7.4	8.0	8.5
20-22	5.1	5.7	6.2	6.8	7.3	7.9	8.4	8.9	9.5
23-25	3.1	6.6	7.2	7.7	8.3	8.8	9.4	9.9	10.5
26-28	7.0	7.6	8.1	8.7	9.2	9.8	10.3	10.9	11.4
29-31	8.0	8.5	9.1	9.6	10.2	10.7	11.3	11.8	12.4
32-34	8.9	9.4	10.0	10.5	11.1	11.6	12.2	12.8	13.3
35-37	9.8	10.4	10.9	11.5	12.0	12.6	13.0	13.7	14.3
38-40	10.7	11.3	11.8	12.4	12.9	13.5	14.1	14.6	15.2
41-43	11.6	12.2	12.7	13.3	13.8	14.4	15.0	15.5	16.1
44-46	12.5	13.1	13.6	14.2	14.7	15.3	15.9	16.4	17.0
47-49	13.4	13.9	14.5	15.1	15.6	16.2	16.8	17.3	17.9
50-52	14.3	14.8	15.4	15.9	16.5	17.1	17.6	18.2	18.8
53-55	15.1	15.7	16.2	16.8	17.4	17.9	18.5	18.1	19.7
56-58	16.0	16.5	17.1	17.7	18.2	18.8	19.4	20.0	20.5
59-61	16.9	17.4	17.9	18.5	19.1	19.7	20.2	20.8	21.4
62-64	17.6	18.2	18.8	19.4	19.9	20.5	21.1	21.7	22.2
65-67	18.5	19.0	19.6	20.2	20.8	21.3	21.9	22.5	23.0
68-70	19.3	19.9	20.4	21.0	21.6	22.2	22.7	23.3	23.9
71-73	20.1	20.7	21.2	21.8	22.4	23.0	23.6	24.1	24.7
74-76	20.9	21.5	22.0	22.6	23.2	23.9	24.4	25.0	25.5
77-79	21.7	22.2	22.8	23.4	24.0	24.6	25.2	25.8	26.3
80-82	22.4	23.0	23.6	24.2	24.8	25.4	25.9	26.5	27.1
83-85	23.2	23.8	24.4	25.0	25.5	26.1	26.7	27.3	27.9
86-88	24.0	24.5	25.1	25.7	26.3	26.9	27.5	28.1	28.7
89-91	24.7	25.3	25.9	25.5	27.1	27.6	28.2	28.8	29.4
92-94	25.4	26.0	26.6	27.2	27.8	28.4	29.0	29.6	30.2
95-97	26.1	26.7	27.3	27.9	28.5	29.1	29.7	30.6	30.9
98-100	26.9	27.4	28.0	28.6	29.2	29.8	30.4	31.0	31.6
101-103	27.3	28.1	28.7	29.3	29.9	30.5	31.1	31.7	32.3
104-106	28.2	28.8	29.4	30.0	30.6	31.2	31.8	32.4	33.0
107-109	28.9	29.5	30.1	30.7	31.3	31.9	32.5	33.1	33.7
110-112	29.6	30.2	30.8	31.4	32.0	32.6	33.2	33.8	34.4
113-115	30.2	30.8	31.4	32.0	32.6	33.2	33.8	34.5	35.1
116-118	30.9	31.5	32.1	32.7	33.3	33.9	34.5	35.1	35.7
119-121	31.5	32.1	32.7	33.3	33.9	34.5	35.1	35.7	36.4
122-124	32.1	32.7	33.3	33.9	34.5	35.1	35.8	36.4	37.0
125-127	32.7	33.3	33.9	34.5	35.1	35.8	36.4	37.0	37.6

*Percent fat calculated by the formula by Siri30. Percent fat = [(4.95/BD)-4.5]x100 where BD = body density.

Although the Brozek equation is highly accurate, its use can be tedious. Table 8.2 can be used to make a quick estimate of body composition.

The leanest athletes in traditional sports usually carry about 5%–8% body fat for men, and 10%–15% for women. Top bodybuilders will drop even lower than these levels, but only for a short time in the 2%–4% range. During off-season, for health reasons and to be able to adequately add muscle and operate in a caloric surplus, these levels will increase.

As a competitive bodybuilder, "If you do not see the outline of your abs and any veins in your arms or legs, you are getting too fat," to quote Branch Warren in a conversation we had. For a competitive bodybuilder, rarely would it make sense to go above 12% body fat in the off-season. Generally, more in the 10% range will make the most sense when bulking up. When you get too fat, not only is more aggressive dieting called for (meaning a more intense catabolic state) but also a longer time in this state is, too. Because you will struggle so hard to get lean enough, preserving muscle mass will be an afterthought.

Look at the example of top bodybuilder Branch Warren in 2006. At 5 feet 7 inches, he would balloon up to 272 pounds in the off-season and then cut down into the 230–240 range for competitions. Now he doesn't allow his off-season weight go beyond the mid-260s.

Because Branch has stayed leaner year-round, he has much more efficient contest prep with no crashing, allowing him to train more intensely. While using this strategy, he has been a perennial Arnold Classic Champion and had numerous Top 10 Mr. Olympia finishes, including second and third place.

Body fat testing is important for the bodybuilder; although it makes no guarantees about symmetrical appearance, it is a good way to track data when bulking or cutting.

If you gain 10 pounds but 9 of those pounds are fat, that is not a very efficient bulk; conversely, if you weigh 200 pounds and drop 4 pounds and your body fat decreases 2%, your cut is spot on.

Whether you're a bodybuilder or a fitness enthusiast, the scale doesn't tell the whole story. Body fat measurements, coupled with scale weight, provide a realistic outlook on what is occurring when cutting or bulking. Generally, body fat testing should be done every two to three months unless more frequent testing is warranted by a special circumstance.

Table 8.3 provides some data ISSA compiled for body fat ranges.

Measurements

As a bodybuilder, you should always remember that you are judged based on the illusion your physique portrays to the judges. A bodybuilder with 17.5-inch arms may appear to have bigger arms than does a bodybuilder with 19-inch arms if his biceps have a better shape when he hits a front dumbbell bicep pose. For instance, if this bodybuilder has smaller joints, he will appear to have bigger biceps.

Table 8.3: Average Body Fat Ranges for Males and Females

	Ages 18–39		Ages 40–59		Ages 60–79	
Factor	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**
Essential fat	2%–4%	10%–13%	2%–4%	10%–13%	2%–4%	10%–13%
Underfat	5%–7%	14%–20%	5%–10%	14%–22%	5%–12%	14%–23%
Healthy	8%–19%	21%–32%	11%–21%	23%–33%	13%–24%	24%–35%
Obese	20%+	33%+	22%+	34%+	25%+	36%+

Because of this, the tale of the tape doesn't tell the whole story, but it sure helps in the assessment process. If a bodybuilder is devoting a specific training block to add size, and a specific focus is set on adding size to the arms, the easiest way to measure efficiency is with a tape—assuming body fat does not spiral out of control.

If your arms were 16 inches and now they are 16.5 inches, they have grown. This is also a great way to track the muscularity illusion as you diet down.

Sure, body fat tells the physiology of what has taken place, but measurements will help evaluate the illusion. If you lose 2 inches off your waist, yet your arms do not drop in size, the illusion is that they have become bigger.

Anyone who has successfully dieted down for bodybuilding has had people say things like, "Wow, you look like you're getting huge." It is funny to proclaim, "I have lost 10 pounds."

That's the illusion a bodybuilder seeks.

Steve Reeves, a bodybuilding pioneer known for his symmetry, believed that once a certain amount of mass had been surpassed, aesthetics would suffer, and symmetry would rapidly disintegrate.

Many who endorse the classical bodybuilding physique still believe in Reeves' ideals. He believed a 6-foot bodybuilder had to weigh less than 200 pounds to be symmetrical; certainly, there have been bodybuilders much larger than that with beautiful symmetry, but the largest mass monsters usually don't have the best symmetry.

Reeves believed that bodybuilders striving for the symmetrical physique should have the proportions listed here.

Arm size	252% of wrist size
Calf size	192% of ankle size
Neck size	79% of head size
Chest size	148% of pelvis size
Waist size	86% of pelvis size
Thigh size	175% of knee size

Girth Measurement Guidelines

- **Take measurements in a relaxed state.** Do not flex the muscle you are measuring and do not measure when the muscles are pumped full of blood. Instead, measure muscles in a natural state at the same time of day each day.
- **Don't leave the tape loose.** Sure, this will give your arms bigger measurements, but not accurate ones, so there will be no way to quantitatively assess data; most bodybuilders lie about their measurements. For your sanity, your measurements should probably remain between you and the person assisting with your contest prep.
- **Measure both sides of the body.**
- **Write down measurements.** This is a great way to assess your physique. Bodyweight, body fat, and measurements won't lie.
- **Measure in the same spot every time.** Your thighs, for example, will be bigger if you measure them right above the knee verses at the butt cheek.

A FEW LAST WORDS

If you want to be a competitive bodybuilder, the only thing that matters is the illusion on stage.

To help create the best illusion on stage, the bodybuilder can assess progress in training by the assessments listed. Do assess your training. To be the best, you will need to do more than stare in the mirror and go by "feel."

I also highly encourage you to get a Photobucket account. It's free and allows you to make comparisons of past photos in a slide show setting.

Take pictures from different angles and save these pictures with the date and your bodyweight; doing the assessments listed and using Photobucket will help make you become the best you can be.

TOPICS COVERED IN THIS UNIT

A Brief History of Periodization

Types of Periodization

ABC Bodybuilding Periodization Model

The Need for Periodization

Review of the Granddaddy Laws

- The Law of Individual Differences
- The Laws of Overcompensation and Overload
- The SAID Principle and the Law of Specificity
- The GAS Principle and the Law of Use/Disuse

Fitness Fatigue Model

Avoiding Overtraining and Overreaching

Creating a Periodized Program

- Age- and Experience-Related Factors
- Macrocycles, Mesocycles, and Microcycles
- Intensity Variables

Sequence of Training

Foundational Training

Bulking/Hypertrophy Training

Competition Prep/Cutting

A Few Last Words

UNIT 9

PERIODIZATION

Periodization is not the latest fad training system. Rather, it simply refers to how one's training is broken down into discrete periods called macrocycles, mesocycles, and microcycles. Periodization is purpose-driven training. It is essentially systematically cycling volume, methods, and intensity toward one's goals.

A BRIEF HISTORY OF PERIODIZATION

The concept of breaking training down into discrete periods of focus is not a new one and is not solely a practice of athletes.

Siff and Verkhoshansky, in their 1996 book, *Supertraining,* noted that ancient civilizations, such as the Chinese, Greeks, and Romans, understood the need for proper physical preparation for warfare. They realized that you could not simply hand a soldier his weapon and start teaching fighting techniques. The first thing soldiers needed was to be whipped into shape.

This same concept applies to you as a bodybuilder. Before you can really focus on developing individual muscles with single-joint movements, you need to build your limit-strength base.

As for athletic training, the ancient Greek Olympians spent time in preparatory training for up to 10 months during each year, even in non-Olympic years.

In a textbook written during the Russian revolution, Kotov (1917) advised that training should be divided into general, preparatory, and specific training stages. Several Russian texts were written after this, emphasizing such training in track and field, skiing, gymnastics, boxing, water polo, and swimming.

One of the earliest examples of periodization reached the Western world in 1946 in England, when Dyson used the Eastern approaches to training and developed a five-phase system of training. It included (a) non-competitive periods, involving gymnasium activities and cross-country running, (b) pre-competitive periods, (c) initial competitive periods, (d) main competitive periods, and (e) post-competitive periods.

Today, all organized athletic teams use periodization. This is due not only to athletes' needs but also to guidelines set by governing bodies. The NCAA, for example, maintains strict guidelines for preseason and off-season training. Thankfully, the bodybuilder does not have to abide by these regulations.

Consider the great bodybuilders of the past who focused on strength and size in the off-season and then fat loss and symmetry as a contest approached.

Cyclically attacking these goals and changing training methods and modalities as objectives were sequentially accomplished represented periodization in action. Just think about it logically. Would a bodybuilder train the same way for a show four weeks out as he would for one four months out?

TYPES OF PERIODIZATION

Linear periodization is also called classic or Western periodization. The basic premise of linear periodization is that the training cycle starts with low intensity and high volume; progressively, the intensity increases, and subsequently, the volume decreases. As reps decrease, the weight used (intensity) increases in each successive mesocycle generally lasting three to four weeks .

For example, Cycle One may consist of 15 reps; Cycle Two, 10 reps; Cycle Three, 10 reps, Cycle

Four, 6 reps; and so on. Intensity and volume are cycled linearly. Although more effective methods of periodization now exist, there is no denying that this approach, which many now consider antiquated, has produced many champions; in powerlifting, Ed Coan and Bill Kazmaier both used this approach, and many top lifters continue to do so today.

Reverse Linear Periodization

This is classical periodization in reverse. Maximum intensity and low volume are at the commencement of the training cycle; then, as the training cycle progresses, volume is increased, and intensity is reduced. Bodybuilders use this approach many times, increasing reps and decreasing weight as a show approaches. From a foundational point of view, this approach is logical; your limit strength is your foundation, and it is the first item addressed.

Undulating Periodization

This is in essence a nonlinear model of periodization. The key is to repeatedly manipulate training variables by frequently adjusting loading parameters. This can be done workout by workout, daily, or weekly. Undulating periodization means training volume and overall intensity are increased or decreased constantly. Generally, this model is more effective for the bodybuilder whose main objective is to provide overload to the muscle, with variables constantly changing by default.

Some studies demonstrate that undulating periodization is significantly more effective than classical periodization is, whereas others show the systems to be roughly equal. The problem is that most of these studies are performed on untrained athletes, not bodybuilders.

Flexible Nonlinear Periodization

This is similar to the undulating training model but allows changes in training based on the readiness of an athlete, which is based on specific tests done pre-workout. Many bodybuilders do a variation, essentially auto regulation; this means that when they feel well they increase intensity, and when they do not feel well, they decrease it.

Block Periodization

Popularized by Vladimir Issurin, block periodization could be called "focused training." This involved giving one quality in training special

Periodization: Refers to how one's training is broken down into discrete time periods called macrocycles, mesocycles, and microcycles.

Linear Periodization: basic premise of this type of periodization is that the training cycle starts with low intensity and high volume; progressively the intensity increases, and subsequently the volume decreases. As reps decrease, the weight used (intensity) increases in each successive mesocycle generally lasting 3–4 weeks.

Reverse Linear Periodization: Maximum intensity and low volume are at the commencement of the training cycle; then, as the training cycle progresses, volume is increased, and intensity is reduced.

Undulating Periodization: Training volume and overall intensity are increased or decreased constantly.

Flexible Nonlinear Periodization: This is like the undulating training model but allows changes in training based on the readiness of an athlete, which is based on specific tests done pre-workout.

Block Periodization: This entails giving one quality in training special emphasis. Using specific exercises that focus on the particular quality you seek, in a conjugate sequence, you maintain your other qualities and then rotate your emphasis and continue maintenance.

emphasis. By using specific exercises that focus on the precise quality you seek, in a conjugate sequence, you can maintain your other qualities and then rotate your emphasis and continue maintenance. This is antithetical to what you see at most commercial gyms, where people concurrently train for multiple goals and generally fail miserably.

For the bodybuilder looking to bring up his arms specifically, he would still train the rest of his body but would increase frequency of arm workouts from once a week to perhaps three to four times. For the bodybuilder seeking to increase strength, his emphasis might be to decrease reps and increase intensity on core lifts, yet he would not eliminate single-joint movements.

Here are Issurin's own words on block periodization:

Its general idea proposes the sequencing of specialized training cycles (i.e., blocks, which contain highly concentrated workloads directed to a minimal number of targeted abilities).

Unlike the traditional model, in which the simultaneous development of many athletic abilities predominates, block-periodized training presupposes the consecutive development of reasonably selected target abilities. The content of block-periodized training is set down in its general principles, a taxonomy of mesocycle blocks, and guidelines for compiling an annual plan.

A study in the June 2012 edition of the *International Journal of Physiology,* titled "Strength Gains: Block Versus Daily Undulating Periodization Weight Training Among Track and Field Athletes," demonstrated greater strength gains over the course of a year for the block method of periodization when compared with the undulating method. This finding was important because the study used trained athletes.

ABC BODYBUILDING PERIODIZATION MODEL

ABC Bodybuilding Periodization Model: A system of training developed by Dr. Fred Hatfield with numerous variables pertaining to recovery. Some of these variables include tolerance to pain, level of "psych," and amount of rest between workouts. Hatfield also determined that the "slow gainer" and the "fast gainer" have different recovery periods.

In an excellent article titled "Finding the Ideal Training Split," Fred Hatfield, PhD, determined numerous variables pertaining to recovery for training splits.

Some of these variables included tolerance to pain, level of "psych," and amount of rest between workouts. Hatfield also determined that the "slow gainer" and the "fast gainer" have different recovery periods.

A "slow gainer" has a higher percentage of type I muscle fiber and can complete 15–20 reps at 80% of his or her one-rep max. A "fast gainer" has a higher percentage of type II muscle fiber and can complete only

Table 9.1: Which Type of Gainer Are You?			
Reps Performed with 80% Max	**Standard Deviation from Mean**	**Tolerance Level**	**Ability to Make Gains**
4 or fewer	–3	Very, very low	Fast Gainer (20%–25% of total population)
4–6	–2	Very low	
6–10	–1	Low	
10–13	Mean	Average	Average Gainer (50%–60% of total population)
13–17	+1	High	Slow Gainer (20%–25% of total population)
17–21	+2	Very high	
21 or more	+3	Very, very high	

4–6 reps at 80% of his or her one-rep max. The athlete should perform this "test" on several muscle groups, as each muscle group has a different tolerance to exercise.

Table 9.1, extrapolated from Hatfield's article, will help you determine which type of gainer you are.

Once you have determined your specific category, the adequate amount of recovery can be determined. Hatfield recommended a different workout with different prescribed levels of intensity: An "A" workout was a low-intensity workout, a "B" workout was a moderate level of intensity, and a "C" workout was a high-intensity workout. Dividing workouts according to intensity levels allows the right levels of fatigue to be accumulated, which ensures that optimal levels of fitness are developed.

In the ABC system, using an example for training the chest, an A workout would be something light such as 65% x 6 reps x 3 sets. A B chest workout might be 75% x 6 reps x 3 sets. Then 3 sets of 12 moderate-weight chest fly would follow. A C workout is most intense and consists of giant sets spanning compound movements—isolation movements with heavy and light weight to holistically tax the muscles.

How often a muscle group is trained depends on whether you are a fast gainer or a slow gainer and what type of workout you have completed. For instance, after a heavy leg day, a slow gainer might rest only five days while a fast gainer may rest seven days.

Typically, a slow gainer will need three to five days of recovery, depending on which muscle group has been worked. Abdominal, calf, and forearm work will need three days of recovery; larger muscle groups, like the legs and lower back, will need five.

The fast gainer will need five to seven days of recovery. Rest the abdominals, calves, and forearms five days; the lower back and legs will need to be rested seven days.

A common objection is that many exercises, particularly compounds, work numerous body parts. Look at a bar dip. If you lean forward with your chin tucked to chest, the emphasis shifts to the chest. If you have more of an upright posture, the triceps become the prime mover. You can shift emphasis, but you cannot eliminate contributions by assisting muscles, not to mention the major contribution of the anterior deltoids.

Hatfield offers a solution: By dividing your split around the compound movement that is being performed in the particular training session, you won't need to try to completely isolate one muscle. Hatfield spoke of movement-based programs prior to their becoming popular; he was ahead of his time in this regard.

In a personal communication with Dr. Hatfield, I learned that he used this system while training

eight-time Mr. Olympia, Lee Haney. Regardless of how you train, intensity and volume must be managed to optimize results; thankfully, pioneers such as Hatfield took this knowledge from the lab into the gym.

THE NEED FOR PERIODIZATION

"Through scientific research and training practice, periodized training proved to be more effective than non-periodized in trained subjects," concluded Vladimir Ilić and Igor Ranisavljević from the Faculty of Sports and Physical Education, Belgrade, Serbia, in their scientific review published for the University Banja Luka, *Faculty of Physical Education & Sports,* November 2010.

But is periodization necessary to look the best on stage?

If so, why?

And why not simply train hard year-round and then diet as a show approaches?

These are seemingly logical questions, so let's look at what noted sports scientists have to say.

The needs for different phases of training were indicated by physiology since the development and perfection of neuro-muscular and cardio-respiratory functions, to mention just a few, are achieved progressively over a long period of time. One also has to consider the athlete's physiological and psychological potential, and that athletic shape cannot be maintained throughout the year at a high level.

—Tudor O. Bompa (*Theory and Methodology of Training,* 1983)

If a bodybuilder tries to stay in contest shape year round, he will inhibit his ability to pack on muscle mass. Because he is seemingly eating a perfect diet year-round, it will be nearly impossible to diet down any further for a contest.

Peaking at just the right time—obviously of key importance to the bodybuilder and athletes—is far from the only benefit of periodized training. You will also gain in strength, power and muscle size . . . Changes in training with a periodized plan also helps [sic] to keep your regimen from becoming boring . . . . Another major reason to switch to periodized training is to prevent injuries.

—Fleck and Kraemer (*Periodization Breakthrough!,* 1996)

REVIEW OF THE GRANDDADDY LAWS

THE LAW OF INDIVIDUAL DIFFERENCES

This law states that not everyone can train in an identical manner. It is relevant to periodization when you consider the fact that the athlete's individual differences will change with training. Each person will become an entirely different individual after a year of proper training. Certainly, a beginner will not keep the same physical and psychological characteristics after training—that person will literally become a different individual in that he or she will be stronger and faster, recover more quickly, and have a different perspective on training than when he or she began. Everyone reacts differently to certain exercises, amounts of volume, rest periods, rep ranges, cardio prescriptions, and so on.

THE LAWS OF OVERCOMPENSATION AND OVERLOAD

Simply put, training must progressively increase in intensity over a set period. Using the same reps, sets, frequency, training loads, and methods of training time after time will not result in increases in performance or muscle mass. This applies even to the advanced bodybuilder; usually, if the same bodybuilder does the same workout repeatedly yet makes some progress, that progress has resulted from a change in nutritional strategy and enhanced pharmacology.

Seven Granddaddy Laws: These include the law of individual differences, the law of overcompensation, the law of overload, the SAID principle, the law of specificity, GAS principle, and the law of use/disuse.

Law of Individual Differences: This law states that not everyone can train in the same manner.

Laws of Overcompensation and Overload: Training must progressively increase in intensity over a period.

THE SAID PRINCIPLE AND THE LAW OF SPECIFICITY

SAID stands for *specific adaptation to imposed demand*. The body will adapt in a highly specific manner to the stress it receives. Simply put, if you want to maximum muscle hypertrophy, you have to train and eat big. If you want to be a bodybuilder, train to maximize muscle mass and minimize body fat. If you want to be a jockey, a much different strategy is required.

SAID Principle: SAID stands for "specific adaptation to imposed demand." body will adapt in a highly specific manner to the stress it receives.

THE GAS PRINCIPLE AND THE LAW OF USE/DISUSE

GAS stands for *general adaptation syndrome*. Periods of high intensity must be followed by periods of low intensity. If you complete only one hard workout, adaptation for larger muscles may take weeks—too long *not* to train! Therefore, there must be frequent periods of low intensity between periods of high intensity. We like to call this *a deload*. This period of lower intensity generally needs to be less than 70% of total volume and intensity. If you were in a state of overreaching, this deload period can invoke supercompensation and maximum hypertrophy, and strength gains will occur during this time.

GAS Principle: GAS stands for "general adaptation syndrome." Periods of high intensity must be followed by periods of low intensity.

FITNESS FATIGUE MODEL

The GAS principle is a single factor model of training that describes your body's short-term and long-term reactions to stress. This principle is the foundation for periodization. This means that if a stress (training stimulus) is great enough, fitness decreases for a time and then "supercompensates" to its original state, and then beyond, which leads to fitness improvements. Fitness and fatigue are variables that determine adaptations to training.

Fitness Fatigue Model: Model looks at the long-term aftereffect from training stimuli.

The fitness fatigue model does not replace GAS; it expands on it. GAS is a one-factor training model, whereas the fitness fatigue model is a two-factor training model. GAS is too simplistic to explain the effects of training. The fitness fatigue model examines the long-term aftereffect from training stimuli. The aftereffect will cause an increase in specific fitness, such as increased thigh mass from a heavy training cycle of squats. The gain in mass is the fitness component. The fatigue effect is the short-term aftereffect from training stressors. Multiple sets of heavy squats will cause fatigue.

Significant delayed onset of muscle soreness (DOMS) is one example of fatigue. Fabled sprints coach, the late Charlie Francis, used to say in his seminars that the CNS is like a cup of tea that you must never let overflow. Every stressor, such as personal problems, interval training, weight training, or lack of sleep, adds tea (in this case fatigue) to your cup. If the cup of tea (fatigue) does not overflow but is adequately stressed, supercompensation (fitness) occurs.

When it comes to weight training, volume is a product of poundage lifted x repetitions x sets. Take a look at a bodybuilder with a maximum bench press of 400 pounds performing three separate workouts on the bench press: If he does 300 pounds x 3 repetitions x 8 sets, a more neural adaptations will occur. If he does 300 pounds x 8 repetitions x 3 sets, more hypertrophic response will be induced. If he does 100 pounds x 24 repetitions x 3 sets, this will serve as an active recovery response.

All three of these set-and-rep schemes will produce a completely different response hormonally and neuromuscular-wise, along with inducing fatigue and increasing fitness during supercompensation, yet each workout entails 7,200 pounds of total volume.

The GAS Principle looks at total work as the sole variable to influence fitness response from training, whereas the fitness fatigue model expands on this simplistic outlook by accounting for not only total volume but also the intensity/magnitude of training stimuli. Remember, squatting 1,000 pounds for a single is different from squatting 100 pounds for 10 reps, even though total volume identical.

Each individual training variable is independent of the others, but the total summation will equate to total fatigue produced and total specific fitness gained. If too much fatigue is accumulated, over time a snowball effect will take place. Initially, this will be overreaching, which may in fact be your immediate desired result, so fitness gained can occur during a period of deloading, but if this goes beyond overreaching to the point of overtraining, it can take months to recover.

A classic example of this situation is when a bodybuilder is severely overreaching and switches to an extremely low-volume program such as the Heavy Duty Training System (discussed in Unit 11). Initially he or she will gain size, because supercompensation is taking place by a de facto deload. These gains will not continue with insignificant stimulation once supercompensation has manifested itself.

Periods of significant fatigue followed by significant recovery produce significant results! Different training methods and stimuli trigger different responses. This is especially true for advanced bodybuilders; beginners are developing a general fitness base and will respond well to most training stimuli.

If you are training for maximal strength, you will not get your best results if you're concurrently attempting to train for maximal endurance capacity. No one has ever run a five-minute mile and bench-pressed 500 pounds raw! Training needs to be purpose-driven and focused on specific goals so specific fitness and fatigue adaptations do not fight against one another; instead, they should concurrently merge for your bodybuilding success.

Before a major contest in track and other sports, athletes taper off training volume to peak at the contest. This idea is the delayed training effect and, in a way, is the whole premise behind the fitness-fatigue model.

After stressful training, a period of lower volume and less intensity (deload) is required for optimal performance to be achieved. Remember, the same applies to you, the bodybuilder: To gain the positive fitness effects after a period of stressful overreaching, a deload is called for to eliminate fatigue aftereffects and for you to make the gains you deserve from hard training.

In 1995, in his book, *Science and Practice of Strength Training,* Vladimir Zatsiorsky stated that in a workout of average intensity, the fitness effect endures roughly three times longer than the fatigue effect does. That means, if the fatigue aspect from a training session dissipated after two days, fitness gains will persist for six days.

AVOIDING OVERTRAINING AND OVERREACHING

Overtraining and overreaching are generally not caused by training too much; in fact, athletes can handle much more training than they or their coaches believe is possible. But, simply put, if athletes are "overtrained," they haven't recovered efficiently. In a sense, they haven't "overtrained"; they have "under-recovered." Overtraining is serious and can sometimes take months to recover from.

At this point, an adverse hormonal response has taken place, signs such as decreased motivation, sex drive, depression, decreased appetite, and insomnia have already started to manifest themselves, and a large decrease in performance is underway.

As overreaching is sometimes a desirable state, it is a much shorter and less severe state of overtraining. Many times, you can recover from this in just a few days. Many periodized training programs purposely invoke phases of overreaching to provide a variety of the training stimulus and to maximize the supercompensation effect during the periods of less intensity.

Another strategy you can use is to alternate between periods of incomplete recovery (overreaching) and periods of complete recovery. Periods of increased loading are alternated with periods of decreased loading, which enhances recovery and helps prevent adaptation to training programs.

One mesocycle might be an intense six-day-a-week split for three weeks, followed by a deload week with a reduction of total/volume and intensity to 60%, followed by three weeks of a more moderate four-day-a-week split.

Overreaching: A much shorter and less severe state of overtraining. Many times, you can recover from this in just a few days. Many periodized training programs purposely invoke phases of overreaching to provide variety of the training stimulus and to maximize the supercompensation effect during the periods of less intensity.

Overtraining: A state reached by an athlete training too hard without proper recovery characterized by decreased motivation, sex drive, depression, decreased appetite, and insomnia along with a large decrease in performance.

If you train hard all the time, too often you will overtrain. However, periodizing your training (mixing periods of high and low intensity not only on a weekly basis, but overall) will result in your ability to recover and train harder more often—thus, *not* overtraining.

CREATING A PERIODIZED PROGRAM

The smart certified bodybuilding coach knows the importance of a periodized program. Let's explore how such training can be organized in a logical manner; it isn't as clear-cut as it may seem. Many factors are involved in creating an effective periodized program. They include:

AGE- AND EXPERIENCE-RELATED FACTORS

Knowing that the Law of Individual Differences does exist, the age and experience level of your particular athlete must be considered, so remember these points:

- Younger athletes will recover more quickly than will older ones.
- Younger athletes are also usually less experienced than are older ones.
- Each athlete will change in experience level and recovery ability during training. Over a lifetime of training, the body will decrease in recovery ability, but during that lifetime, it will also undergo certain training effects that allow for harder and more frequent training.

With these points in mind, you must remember that younger bodybuilders with less competition experience will need a foundational regimen focused on core strength movements.

As your athletes progress and mature, more bodybuilding-specific training will be needed, and the foundational period, while remaining important, can be shortened.

A novice bodybuilder could benefit from two full 12-week powerlifting cycles yearly, focused on gaining strength in core movements and adding size. But this would not be necessary for a Ronnie Coleman or a Jay Cutler in the twilight of his career.

Macrocycle: A macrocycle can be thought of as an entire training period.

Mesocycle: A mesocycle is a periodic breakdown in a macrocycle.

Microcycle: A microcycle is described as one cycle in intensity.

MACROCYCLES, MESOCYCLES, AND MICROCYCLES

These terms are used to describe the discrete breakdown of training goals and varying intensity levels.

Macrocycles. A macrocycle can be thought of as an entire training

period. Although it is generally thought of as a year, that is not always the case. For the national-level bodybuilder, this would be like preparation for the USA's in a hope to win a pro card.

The bodybuilder's yearly plan is important because it guides his or her training over a year. The objective of his preparation is to reach a peak level of performance in a methodical manner for a major show.

The preparatory phase consists primarily of foundational training compound movements but, of course, must include some single-joint movements. This could last as little as eight to twelve weeks for the seasoned pro and literally a year plus for the undersized amateur who earns his pro card and hopes to make a splash in the pro ranks.

Some top pros have taken more than a year after earning their pro card for serious foundational training; it has worked well for perennial Arnold Classic Champion Branch Warren, a top Mr. Olympia competitor.

Those in the trenches refer to this as the *off-season*, as during this phase, bodybuilders are generally trying to add muscle mass and bring up weak points. Adding an inch to your arms is impossible in a state of reduced caloric intake, as the body is not in a caloric surplus anabolic environment. Thus, increasing caloric intake in this phase is also important (Unit 12 covers this in detail.)

The competitive phase of training may contain a few major competitions, each containing a pre-competitive and a main competition. Many bodybuilders will do a state championship prior to nationals as a tune-up. This can be very advantageous, but it can also be detrimental to the inexperienced competitor without a qualified coach.

During this phase, the competitor is minimizing body fat and maximizing symmetry through nutritional strategies, low-intensity aerobic training and/or high-intensity interval training (HIIT), supplementation of fat-burning agents, and a greater emphasis on single-joint movements without completely eliminating foundational movements.

The transition phase of training is used primarily for biological regeneration via psychological rest and physical relaxation, and it can be used to maintain general physical preparation. This phase generally lasts about one month, in some cases longer. Ronnie Coleman was known to stretch this phase up to four months; though this was excessive, it certainly gave him the rest he needed to heal up and attack the iron with ferocity.

Mesocycles. A mesocycle refers to the main training target for particular period (e.g., a mesocycle focusing on hypertrophy, a mesocycle focusing on strength, etc.). Variables within a mesocycle can be manipulated to allow for progression; however, the focus of mesocycle stays the same. An example of a mesocycle could be a 12-week prep for a show. This mesocycle could comprise three to four microcyles lasting 3–4 weeks each.

Microcycles. A microcycle is described as one cycle in intensity. Recall that periods of high intensity must be followed by periods of low intensity before another period of high intensity can occur. For certain muscles, this could take as little as five days and as much as three weeks! Ken Lain, champion bench presser from the 1990s, said it took him three weeks to recover from a heavy bench press. (Granted, we are talking more than 700 pounds.) Although a microcycle is often thought of as "one week," this is not always the case. It can be as small as one workout.

INTENSITY VARIABLES

Using the same reps, sets, frequency, training loads, and methods of training time after time

will not help you get stronger or become more muscular; your muscles simply adapt, so you are no longer overloading them.

A bodybuilder should not have a "routine" if the identical method of training is used year in and year out. Regardless of where the bodybuilder is in the macrocycle, if the routine stays the same, the athlete will not continually make gains unless there are improved nutritional strategies and a heavy dose of pharmaceuticals.

What's the answer?

Besides switching the focus of training, intensity must be increased. If you do not progressively overload your training, you will not make gains. Increasing intensity is more complex than simply piling more weight on the bar, although that is an effective way to do so.

All intensity variables can be quantitatively tracked; this is why it is important to keep a training journal. Here are some effective ways to increase intensity:

1. Increase the training pounds. Increasing the amount of weight you use in a given exercise workout is the most obvious way to increase intensity. Heavy Metal superstar Henry Rollins, when writing about his passion for lifting weights, said, "Two hundred pounds is always 200 pounds, the iron never lies."

Though simplistic, this is a concept many seem not to grasp. Because this is true, 210 pounds is 10 pounds more than 200 pounds; if you previously had used 200 pounds for your heaviest bench press set, now you have used 210 pounds, and you have effectively overloaded your system in a way that can be tracked quantitatively.

Use more weight than you are accustomed to, and your body gets an overload. That is why those who care only about how much they lift, yet routinely add more weight to the bar, assuming their form is not compromised, continually add muscle and get stronger.

This is the oldest tried-and-true way to increase intensity, although many modern-day gurus may dismiss it. It worked for Ronnie Coleman, arguably the greatest bodybuilder of all time and also one of the strongest men of all time.

A piece of advice here.

Look beyond 25-pound plates and 45-pound plates.

Many bodybuilders add weight to the bar using only 25- and 45-pound plates, and this is a mistake. For someone of the advanced strength level, a jump of 50 pounds (a 25-pound plate on each side of the bar) can take years. Thus, incremental jumps must be small; by even adding 1-pound plates, you have still made gains.

If your gym also has 2.5-pound plates, 5-pound plates, and 10-pound plates, use them!

Charles Poliquin stated that *a 10-pound gain in a major core lift generally equates to a 1-pound lean-tissue gain.*

If this doesn't convey to the bodybuilder the importance of getting stronger, nothing will.

2. Increase total volume. Volume is weight x repetitions x sets. Although this obviously increases intensity, the key is to increase volume within a given time frame. For example, by performing 5 sets of 5 reps in the squat with 300 pounds, the total volume is 5 x 5 x 300 = 7,500 pounds. If you did 5 sets of 10, the volume doubles: 5 x 10 x 300 = 15,000 pounds.

Clearly, intensity has been increased, but the key to getting the desired results is to perform this total volume in the same duration of time. If you did the 5 sets of 5 in 15 minutes, as you increase volume, try to keep it in the same time frame so you can progressively add a rep to each set

weekly and gradually intensify the workout without increasing the duration. In turn, this will not adversely affect the desired adaptations, and recovery and intensity variables can be compared on an apples-to-apples basis. Obviously, there are countless more examples.

3. Use bodybuilding methods. Use those that have been shown to increase intensity, such as drop sets, rest pauses, forced reps, negatives, and cheating. Even things like pre-exhaustion and superset/giant sets can significantly intensify a workout. These methods will be discussed in greater detail in Unit 11.

Squatting 500 pounds fresh is much different from doing so after performing multiple sets of lunges, glute kickbacks, leg extensions, and leg curls to exhaustion. If you could do it fresh, now do it after pre-exhaustion. In turn, you have increased intensity and made some gains.

The key to using these principles is to not overdo it and to be able to track what you do. Quantitatively tracking a drop set can be tough; if you performed fewer reps on your heaviest set but more on your third drop than in the previous week, it is tough to quantitatively measure the training effect.

If you use pre-exhaustion, to what extent did you pre-exhaust? That is why you should be able to quantitatively track training—to ensure progress is being made.

4. Increase sets. Although this could be part of total volume, we will take a slightly more abstract view.

If you did 3 sets of 8 repetitions on the bench press with 250 pounds last week, and this week you are able to do 5 sets of 8 repetitions with the same weight, you have increased intensity and have made progress. This method can be quantitatively tracked very easily.

***5.* Increase repetitions.** Last week, if you bench-pressed 250 pounds for 8 repetitions and this week you do it for 10, congratulations—you have made progress! Intensity has increased in a way that is easily measurable.

6. Decrease rest periods. Using the bench-press workout of 250 pounds for 3 sets of 8 repetitions, if last week a 3-minute rest was taken between sets and this week a 2-minute rest is taken, let's look at the amazing increase in intensity:

250 pounds x 8 x 3 last week took 10 minutes to accomplish (total rest periods and lifting duration); this week it took only 7 minutes—a huge intensity boost.

7. Increase mechanical work/decrease leverage. This could also be called leverage manipulation or mechanical disadvantage. For instance, when performing a low bar squat with a wider-than-shoulder-width stance, you move the weight a shorter distance than when using a hip-width foot stance/high bar placement squat (Olympic squat). The range of motion on the powerlifting squat from bottom position to start position might be 16 inches, whereas on the Olympic squat it may be 22 inches.

Mechanical work is measured by the weight being used x the distance being covered. If you squat 350 pounds x 10 reps in the powerlifting squat, the total mechanical work performed for 1 set of squats is 350 x 10 x 16 = 56,000 pounds. (The 350 pounds is the weight on the bar, 10 is the number of repetitions, and 16 is the range of motion from bottom to completion; we are not factoring in the eccentric movement.)

Now let's look at the total amount of mechanical work performed for an Olympic squat using the same sets, reps, and weight: 350 x 10 x 22 = 77,000 pounds, which is quite an increase.

Not only is more mechanical work performed, it is typically performed with a less powerful stance.

Intensity can also be increased just as easily by adjusting the angle an incline press is performed or adjusting the stance when doing a deadlift; mechanical work and leverage manipulation should not be overlooked by the bodybuilder seeking to optimize his physique and attack muscles from different angles.

8. Add bands and chains. Unit 5 is dedicated to the benefits of using bands and chains. Although strength sports and more traditional athletics have jumped on this bandwagon, bodybuilders are the last to climb aboard. Bands and chains can help develop strength through sticking points and intensify a lift throughout its entire range of motion. And as leverage improves, so does resistance.

Numerous other ways exist to increase training intensity, and that is the goal of progressively overloading your training. It is much more complex than simply adding weight to the bar; the key is to know the science of increasing intensity in your workouts but, at the same time, possess the creativity of an artist. The best trainers are able to synergistically blend the art and science of intensity variable manipulation.

Sequence of Training: order in which you do your lifts in a given workout.

SEQUENCE OF TRAINING

A dilemma that often plagues the novice bodybuilder and coach is, "What should I do first?" All exercises are important, but which ones should be done first?

Because speed and explosive movements require much of the body's resources, they hold precedence in order of training. Although this is generally not a concern for the bodybuilder if Olympic movements or their variations are trained in the off-season, keep this in mind: because bigger muscles require more energy and effort than smaller muscles do, bigger muscles should be done first.

Multiple joint movements also require more energy and effort than smaller muscles do, and they, too, should be done first. As is true for flexibility training, the rule is, resistance training should never be done when the body is not fully warmed up.

Training is not limited to the weight room. Medical, nutritional, and supplemental technologies must be applied at all times. During training, psychological techniques and therapeutic modalities must also be applied.

Keep these points in mind while also adhering to some general guidelines for proper order of exercises, drills, and flexibility training:

1. Psychological training (visualization, concentration, etc.)
2. Warm-up
3. Dynamic flexibility training
4. Explosive training (CAT) (if applicable)
5. Multiple-joint movements
   a. Squats
   b. Bench press
   c. Dips, overhead press, etc.
6. Single-joint movements (Isolation)
   a. Larger muscles
   b. Smaller muscles
7. Flexibility training (static stretching, SFMR)
8. Cooldown
9. Application of appropriate therapy (ice treatment, TENS, etc.)

FOUNDATIONAL TRAINING

Foundational Training: main purpose of foundational training is to strengthen your weaknesses, recover from any injuries, and develop a "foundation" of strength in all muscles, tendons, ligaments, and health and fitness.

The primary purpose of foundational training is to strengthen your weaknesses, recover from any injuries, and develop a "foundation" of strength in all muscles, tendons, ligaments, and health and fitness. Usually, this entails training for limit strength, but it can also involve the most nonspecific components of fitness involved in bodybuilding. If you get out of breath walking up a flight of stairs, some cardiovascular training will need to be performed.

Because limit strength is not a major component of any sport other than powerlifting (although limit strength is important), it is usually the sole focus of this period. Its importance cannot be over emphasized for you, the bodybuilder. The higher your one-repetition max on squat, the more weight you can do for a set of 10 on squats.

There are two ways to gain strength: (a) by improving neural coordination (increasing neural coordination in the movement from more efficient motor-unit recruitment by way of the central nervous system) and (b) by increasing cross-sectional muscle fiber areas.

This essentially means 50% of the ways to become stronger are via gaining muscle mass. For this reason, we have provided a few examples

of "powerlifter peaking cycles" as a basic plan for developing limit strength.

For athletes other than powerlifters, slight modifications should be made, as these athletes have no reason to perform one-repetition maximum lifts. Percentages, if listed, are of one-repetition max at the beginning of the program.

Ed Coan's 300-Pound Bench Press Routine

If you bench press 180 pounds, multiply weights by 0.6 (180/300). Divide your goal max by 300 pounds for your weights.

Ed Coan's 300-Pound Bench Press Routine	
Week	**Weight x Sets x Reps**
Week 1	190 x 2 x 10
Week 2	190 x 2 x 10
Week 3	200 x 2 x 8
Week 4	210 x 2 x 8
Week 5	220 x 2 x 5
Week 6	230 x 2 x 5
Week 7	240 x 2 x 5
Week 8	250 x 2 x 3
Week 9	260 x 2 x 3
Week 10	270 x 2 x 2
Week 11	290 x 2 x 2
Week 12	300 x 1 x 1

Ken Lain's Bench Press Routine

This is for someone who wants to go from a 275-pound to a 325-pound bench press.

Ken Lain's Bench Press Routine	
Monday (heavy) & Thursday (light) assistance exercises	Flat dumbbell flyes: 4 sets x 10 reps Weighted dips: 4 sets x 8–10 reps Military press: 4 sets x 8–10 reps Front lateral raise: 4 sets x 8–10 reps Close-grip bench press: 4 sets x 8–10 reps Triceps push-downs: 4 sets x 8–10 reps
Tuesday (heavy) & Friday (light) assistance exercises	Lat pull-downs: 4 sets x 10 reps Chin-ups: 4 sets of 10 reps (You can choose which one you'll do, but do either the lat pull-down or chins each Tuesday and Friday workout) Dumbbell pull-over: 4 sets x 8–10 reps Seated cable row: 4 sets of 8–10 reps Bent-over barbell row: 4 sets of 8–10 reps (You can choose which one you'll do, but do either the seated cable row or bent-over barbell row each Tuesday and Friday workout.) Barbell curl: 4 sets x 8–10 reps Dumbbell curl: 4 sets x 8–10 reps
Legs	Squats: Do 1–2 warm-up sets followed by 3 heavy sets of 5–8 reps Leg extension: 5 sets x 12 reps Leg curl: 4 sets x 10 reps Seated calf raise: 5 sets x 12 reps

Ken said that on week 8, he stops doing all assistance exercises and focuses his strength and energy solely on the bench press. On the days he doesn't train—Wednesday, Saturday, and Sunday—he'll minimize all other physical activity and give his body plenty of time to rest and recuperate. That also means getting at least 7 hours of sleep each night.

The Power Bench Program

The Power Bench Program	
Week 1	**Monday** (heavy workout)—Use @ 55% of target maximum weight (e.g., 325 pounds) Do 2–3 light warm-up sets 3 sets of 10 reps with 180 pounds Do heavy weight assistance exercises **Thursday** (light workout)—Use @ 80% of weight used on Monday's workout Do 2–3 light warm-up sets 3 sets of 10 reps with 145 pounds
Week 2	**Monday** (heavy workout)—Use @ 60% of target maximum weight (e.g., 325 pounds) Do 2–3 light warm-up sets 3 sets of 9 reps with 195 pounds **Thursday** (light workout)—Use @ 80% of weight used on Monday's workout Do 2–3 warm-up sets 3 sets of 9 reps with 155 pounds
Week 3	**Monday** (heavy workout)—Use @ 65% of target maximum weight (e.g., 325 pounds) Do 2–3 light warm-up sets 3 sets of 8 reps with 210 pounds **Thursday** (light workout)—Use @ 80% of weight used on Monday's workout Do 2–3 warm-up sets 3 sets of 8 reps with 170 pounds
Week 4	**Monday** (heavy workout)—Use @ 70% of target maximum weight (e.g., 325 pounds) Do 2–3 light warm-up sets 3 sets of 7 reps with 225 pounds **Thursday** (light workout)—Use @ 80% of weight used on Monday's workout Do 2–3 warm-up sets 3 sets of 7 reps with 180 pounds
Week 5	**Monday** (heavy workout)—Use @ 75% of target maximum weight (e.g., 325 pounds) Do 2–3 light warm-up sets 3 sets of 6 reps with 245 pounds **Thursday** (light workout)—Use @ 80% of weight used on Monday's workout Do 2–3 warm-up sets 3 sets of 6 reps with 195 pounds
Week 6	**Monday** (heavy workout)—Use @ 80% of target maximum weight (e.g., 325 pounds) Do 2–3 light warm-up sets 3 sets of 5 reps with 260 pounds **Thursday** (light workout)—Use @ 80% of weight used on Monday's workout Do 2–3 warm-up sets 3 sets of 5 reps with 210 pounds
Week 7	**Monday** (heavy workout)—Use @ 85% of target maximum weight (e.g., 325 pounds) Do 2–3 light warm-up sets 2 sets of 4 reps with 275 pounds **Thursday** (light workout)—Use @ 80% of weight used on Monday's workout Do 2–3 warm-up sets 2 sets of 4 reps with 220 pounds
Week 8	**Monday** (heavy workout)—Use @ 90% of target maximum weight (e.g., 325 pounds) Do 2–3 light warm-up sets 2 sets of 3 reps with 290 pounds **Thursday** (light workout)—Use @ 80% of weight used on Monday's workout Do 2–3 warm-up sets 2 sets of 3 reps with 230 pounds
Week 9	**Monday** (heavy workout)—Use @ 95% of target maximum weight (e.g., 325 pounds) Do 2–3 light warm-up sets 1 set of 2 reps with 310 pounds **Thursday** (light workout)—Use @ 80% of weight used on Monday's workout Do 2–3 warm-up sets 1 set of 2 reps with 250 pounds
Week 10	**The Day You Bench 325 pounds** **Monday** (heavy workout)—Use @100% of target maximum weight (e.g., 325 pounds) Do 2–3 light warm-up sets 1 rep with 275 pounds 1 rep with 310 pounds 1 rep with 325 pounds

After completing the 10-week program, give your body a week off from training. (Ken recommends up to 21 days to recover from an all-out training program and world-record lift, so judge your body accordingly.) Following a rest break from training, do only regular workouts for one month before beginning your next 10-week program.)

Josh Bryant's 8-Week Routine for Deadlifts

The following is an 8-week routine I designed for my "Deadlift Encyclopedia" article that appeared in *Muscle & Fitness*.

Josh Bryant's 8-Week Routine for Deadlifts			
Perform one day per week:		**Perform one day per week:**	
Week 1	Deadlift: 75% weight, 3 reps, 1 set Deadlift: 60% weight, 6 reps, 3 sets (60-second rest interval between sets) 3-inch deficit deadlifts: 65% weight, 5 reps, 2 sets Bent over rows: 8 reps, 3 sets Shrugs: 12 reps, 3 sets Chin-ups: Max weight, 10 reps, 3 sets Glute ham raises: 8 reps, 3 sets	**Week 5**	Deadlift: 90% weight, 2 reps, 1 set Deadlift: 75% weight, 2 reps, 4 sets (120-second rest interval between sets) 3-inch deficit deadlifts: 80% weight, 3 reps, 3 sets One-armed row: 6 reps, 3 sets Shrugs: 10 reps, 3 sets Chin-ups: Max weight, 4 reps, 3 sets Glute ham raises: 8 reps, 3 sets
Week 2	Deadlift: 80% weight, 3 reps, 1 set Deadlift: 60% weight, 8 reps, 3 sets (60-second rest interval between sets) 3-inch deficit deadlifts: 68% weight, 5 reps, 2 sets Bent over rows: 7 reps, 3 sets Shrugs: 12 reps, 3 sets Chin-ups: Max weight, 7 reps, 3 sets Glute ham raises: 8 reps, 3 sets	**Week 6**	Deadlift: 95% weight, 2 reps, 1 set Deadlift: 80% weight, 2 reps, 3 sets (120-second rest interval between sets) 3-inch deficit deadlifts: 82.5% weight, 3 reps, 3 sets One armed row: 6 reps, 3 sets Shrugs: 10 reps, 3 sets Chin-ups: Max weight, 3 reps, 3 sets Glute ham raises: 7 reps, 3 sets
Week 3	Deadlift: 85% weight, 3 reps, 1 set Deadlift: 70% weight, 6 reps, 3 sets (90-second rest interval between sets) 3-inch deficit deadlifts: 75% weight, 4 reps, 2 sets Bent over rows: 6 reps, 3 sets Shrugs: 12 reps, 3 sets Chin-ups: Max weight, 6 reps, 3 sets Glute ham raises: 8 reps, 3 sets	**Week 7**	Deadlift: 100% weight, 1 reps, 1 set Deadlift: 85% weight, 2 reps, 3 sets (120-second rest interval between sets) 3-inch deficit deadlifts: 88% weight, 1 rep, 3 sets One-armed row: 6 reps, 3 sets Shrugs: 10 reps, 3 sets Chin-ups: Max weight, 3 reps, 3 sets Glute ham raises: 7 reps, 3 sets
Week 4	Deadlift: 60% weight, 1 rep, 6 sets Lat pull-downs: 8 reps, 3 sets Shrugs: Light weight, 12 reps, 3 sets Glute ham raises: 6 reps, 2 sets	**Week 8**	Repeat Week 4 **Week 9** Test your new max!

Brad Gillingham's Deadlift Routine for Intermediate Lifters

This routine is designed for an intermediate lifter seeking to maximize deadlift strength.

Brad Gillingham is a five-time IPF World Powerlifting Champion and a twelve-time USAPL National Powerlifting Champion. Brad has set twelve IPF Masters world records with highlights that include an 881-pound deadlift at the 2010 IPF World Championships in Potchefstroom, South Africa, along with 2,300+ pound totals in numerous meets in single-ply gear. As a masters lifter, Brad set an IPF Open world record in the new 120+ kg class with a deadlift of 395 kg (870 pounds) at the 2011 IPF Pacific Invitational in Melbourne, Australia, on July 31, 2011. Brad recently broke this record at the 2011 IPF World Championships in Pilsen, Czech Republic, with a deadlift of 397.5 kg (876 pounds). Brad is a member of numerous strength Halls of Fame ranging from the state to

international level. Even more impressive, all of Brad's lifts were completed in drug-tested meets. Clearly, when Brad speaks, we listen!

Brad Gillingham's Deadlift Routine for Intermediate Lifters	
Phase 1—conditioning and developing base strength	
Weeks 1–4	Power cleans—2 sets 5 reps Deadlift from floor—2 sets of 10 reps at 65% Power rack lockouts above knee Shrugs—3 sets 10 reps Bent Rows—3 sets 10 reps Seated rows and/or lat pull-downs—3 sets 10 reps
Phase 2—peak strength development phase	
Weeks 1, 3, 5, 7, 9	Power cleans—2 sets 5 reps Power rack lockouts—2 notches (above knee—below knee) Shrugs—3 sets 10 reps Bent rows—3 sets 10 reps Seated rows and/or lat pull-downs—3 sets 10 reps
Assistance work should remain the same for weeks 2, 4, 6, 8, and 10	
Week 2	Deadlift from floor—2 sets 5 reps at 75% Bent rows—3 sets 10 reps Seated rows and/or lat pull-downs—3 sets 10 reps
Week 4	Deadlift from floor—2 sets 5 reps at 80%.
Week 6	Deadlift from floor—2 sets 5 reps at 85%.
Week 8	Deadlift from floor—2 sets 3 reps at 90%.
Week 10	**10 days from meet** Deadlift from floor—2 sets 3 reps at 95%

Josh Bryant's 8-Week Squat Routine

The following is the routine I designed for *Muscle and Fitness* magazine.

Josh Bryant's 8-Week Squat Routine			
Perform one day per week:			
Week 1	Squats: 80%, 3 reps, 6 sets Dead squats (hip/knee angle same stance as deadlift): 1 rep, 3 sets Front squats: 5 reps, 2 sets Leg curls: 8 reps, 3 sets Calf raises: 30 reps, 4 sets Planks (hold 1 minute): 1 rep, 3 sets Side bends bar on your back: 12 reps, 3 sets		
Week 2	Squats: 83%, 3 reps, 5 sets Dead squats (hip/knee angle same stance as deadlift): 1 rep, 3 sets Front squats: 5 reps, 2 sets Leg curls: 8 reps, 3 sets Calf raises: 30 reps, 4 sets Planks (hold 1 minute): 1 rep, 3 sets Side bends bar on your back: 12 reps, 3 sets		
Week 3	Squats: 86%, 3 reps, 4 sets Dead squats (hip/knee angle same stance as deadlift): 1 rep, 3 sets Front squats: 5 reps, 2 sets Leg curls: 8 reps, 3 sets Calf raises: 30 reps, 4 sets Planks (hold 1 minute): 1 rep, 3 sets Side bends bar on your back: 12 reps, 3 sets		
Week 4	Squats: 60%, 2 reps, 4 sets Light front squats: 6 reps, 2 sets Leg curls: 12 reps, 2 sets Planks (hold 1 minute): 6 reps, 2 sets		
Week 5	Squats: 91%, 2 reps, 5 sets Pause squats: 3 reps, 3 sets Front squats: 3 reps, 3 sets Leg curls: 12 reps, 3 sets Calf raises: 25 reps, 4 sets Planks (hold 1 minute): 1 rep, 3 sets Side bends bar on your back: 12 reps, 3 sets		
Week 6	Squats: 95%, 2 reps, 4 sets Pause squats: 3 reps, 3 sets Front squats: 3 reps, 3 sets Leg curls: 12 reps, 3 sets Calf raises: 25 reps, 4 sets Planks (hold 1 minute): 1 rep, 3 sets Side bends bar on your back: 12 reps, 3 sets		
Week 7	Squats: 100%, 2 reps, 3 sets Pause squats: 3 reps, 3 sets Front squats: 3 reps, 3 sets Leg curls: 12 reps, 3 sets Calf raises: 25 reps, 4 sets Planks (hold 1 minute): 1 rep, 3 sets Side bends bar on your back: 12 reps, 3 sets		
Week 8	Repeat Week 4	**Week 9**	Max out!

Josh Bryant's 13-Week Squat Routine

Here is a squat routine I have used successfully to achieve gains of well over 10% in the squat.

Josh Bryant's 13-Week Squat Routine			
Perform one day per week:		**Perform one day per week:**	
Week 1	Squat: 80% x 3 reps Squats (CAT): 65% x 4 x 6 sets (rest 1 minute) Olympic pause squats: 5 x 2 sets Glute ham raises: 3 x 6 reps One leg squat: 3 x 6 reps Weighted abs: 6 sets	**Week 7**	Squat: 101% x 2 reps Squats (CAT): 75% x 3 x 6 sets (rest 2 minutes) Band resisted squats: 1 x 3 sets Glute ham raises: 3 x 6 reps One leg deadlift: 3 x 6 reps Weighted abs: 6 sets
Week 2	Squat: 85% x 3 reps Squats (CAT): 65% x 4 x 8 sets (rest 1 minute) Olympic pause squats: 5 x 2 sets Glute ham raises: 3 x 6 reps One leg squat: 3 x 6 reps Weighted abs: 6 sets	**Week 8**	Deload
Week 3	Squat: 88% x 3 reps Squats (CAT): 65% x 4 x 10 sets (rest 1 minute) Olympic pause squats: 5 x 2 sets Glute ham raises: 3 x 6 reps One leg squat: 3 x 6 reps Weighted abs: 6 sets	**Week 9**	Squat: 95% x 1 rep, 105% x 1 rep Squats (CAT): 80% x 2 x 6 sets (rest 2.5 minutes) Pause squats chains: 5 x 2 sets Glute ham raises: 3 x 6 reps One leg press: 3 x 6 reps Weighted abs: 6 sets
Week 4	Deload	**Week 10**	Squat: 98% x 1 rep, 109% x 1 rep Squats (CAT): 84% x 2 x 5 sets (rest 2.5 minutes) Pause squats chains: 4 x 2 sets Glute ham raises: 3 x 6 reps One-leg press: 3 x 6 reps Weighted abs: 6 sets
Week 5	Squat: 92% x 2 reps Squats (CAT): 75% x 3 x 4 sets (rest 2 minutes) Band resisted squats: 3 × 4 sets Glute ham raises: 3 x 6 reps One leg deadlift: 3 x 6 reps Weighted abs: 6 sets	**Week 11**	Squat: 101% x 1 rep, 113% x 1 rep Squats (CAT): 88% x 2 x 4 sets (rest 2.5 minutes) Pause squats chains: 3 x 2 sets Glute ham raises: 3 x 6 reps One-leg press: 3 x 6 reps Weighted abs: 6 sets
Week 6	Squat: 97% x 2 reps Squats (CAT): 75% x 3 x 5 sets (rest 2 minutes) Band resisted squats: 2 x 4 sets Glute ham raises: 3 x 6 reps One leg deadlift: 3 x 6 reps Weighted abs: 6 sets	**Week 12**	Deload
		Week 13	Max out!

BULKING/HYPERTROPHY TRAINING

After building your base during foundational training, focus your next stage on hypertrophy. This is commonly referred to as the bulking phase. Some athletes prefer to stay somewhat lean year-round, whereas smaller bodybuilders may use this time to add a significant amount of extra mass. Either way, all bodybuilders undergo some form of bulking period during the year.

The goal of the bulking phase is simple: to increase muscle mass! The bulking phase is also when the bodybuilder takes time to bring up his or her lagging body parts. If during your last competition the judges thought your arms were too big compared with your shoulders, then during the bulking phase, you would target your deltoids to increase their size.

A bulking phase does not have a specific duration. Duration depends on an array of factors, such as when the next competition is, when the last competition was, whether you are undersized or oversized, and whether you have body parts that are lagging far behind others.

COMPETITION PREP/ CUTTING

You laid your foundation, you added some serious muscle mass, but what is next? The next step is getting ready for the stage! The competition prep, or "cutting" phase, is when you really see the fruits of your labor.

The goals of the cutting phase include losing fat, enhancing symmetry, and "tightening up," as the bodybuilders say. You have probably heard bodybuilders talk about conditioning. Conditioning refers to three things: separation of the muscle groups, striations, and vascularity. Conditioning is an important part of being a champion bodybuilder, and the cutting phase is when you become conditioned.

For you to achieve a successful cut, you must be in a caloric deficit. In other words, you must be burning more calories than you are taking in. Some believe that a cutting phase is synonymous with lots of cardio, but this is not always the case. If you are in a caloric deficit without doing cardio, then there is no need to get on the Stairmaster for an hour.

During the cutting phase, we want to try to preserve as much muscle mass as possible. Many new bodybuilders cut their calories way too low and end up losing a great deal of the muscle they have been working hard to build. By following the guidelines in the nutrition section of this book (Unit 12), you can keep the maximum amount of muscle while losing fat.

While the bodybuilder is attempting to cut fat, his or her training frequency is oftentimes increased. My recommendation concerning training frequency during a cut is that the athlete should be lifting AT LEAST five days a week and, depending on the athlete, may need to train seven days a week.

The change in lifting routine during the cutting phase will not be extreme, but a few adjustments will be made to maximize fat burning. The biggest change during this time will be an increase in cardio training. To really torch the fat, you will want to do high-intensity interval training (HIIT) two to three times per week. Doing high-intensity cardio training will preserve muscle mass during the cut much better than long, slow cardio will. Many bodybuilders will opt for long, slow cardio during the cutting process. While I would not recommend this, champion bodybuilders have used this method to help with fat loss.

Here are some parameters for you to follow in the weight room during your cut:

- Use superset, tri-sets, and giant sets.
- Find other ways to increase intensity (shorter rest periods, drop sets, tempo sets, etc.)
- Keep rests between exercises as short as possible.
- If you find yourself lacking energy (due to the caloric deficit), try breaking up your training sessions into two workouts, one in the morning and one in the evening.

As with the bulking phase, the amount of time that a cut should last primarily depends on the individual athlete. If you need to lose from five to fifteen pounds, then the cut can be relatively short (eight to twelve weeks). If the athlete must lose fifteen pounds or more, then the cut is going to be longer (twelve to twenty weeks).

The following is a sample twelve-week cutting cycle that incorporates HIIT along with weight room modalities.

12-Week Cutting Cycle using HIIT and weight room modalities

Weeks 1–3

Day 1	Giant Set: (Bench Press x 5, Incline Dumbbell Fly x 15, Dumbell Pullovers x 30) x 3 Superset: (Incline Dumbell Press (5-second eccentric), Wide Grip Pullups x max repetitions) x 3 Weighted Dips: 5×10 Standing Cable Fly: 200 repetitions, resting 15 seconds at failure with a 20RM load
Day 2	Deadlift: 12,8,4,2,1 repetitions T-Bar Row: 8×10 repetitions with a 12RM load Neutral Grip Pullup: As many sets of 5 as possible with 30-second rests between sets Seated Row Dropset: 4 drops total
Day 3	Hill Sprints @ 90%: 40 meters x 10 reps. Rest as you walk back down the hill.
Day 4	Giant Set: (Lean-Away Lateral Raises x 12, Rear Delt Swings x 30, Arnold Press x 12) x 3 Cable Lateral Raise (5-second eccentric) x 15,12,10,8 Reverse Pec Deck: 6 x 15 Jump Rope: 30 seconds on/30 seconds off for 8 minutes Stability Ball Crunches x 3 x 20
Day 5	Squat: 10, 8, 6, 4, 2, 4, 6, 8, 10 reps Giant Set: (Leg Press x 15, Laying Leg Curls x 20, Leg Extension x 35) x 3 Superset: (Slider Leg Curls x 15, Body Weight Squat x 40) x 3
Day 6	Superset: (Incline Dumbell Curls x 12, Skull Crushers with 5-second eccentric x 8) x 3 Preacher Curls: "21s" (7 bottom half reps, 7 top half reps, 7 full reps) x 5 sets Standing Overhead French Press with 5-second eccentric x 4 x 8 Superset: (Triceps Pushdown (rope attachment) x 25, Cable Curls (rope attachment) x 25) x 3 Hill Sprints: 90% x 8 x 40 meters.
Day 7	Rest

Week 4 – Deload week

Reduce load by one-third and focus on mind-muscle connection.

Weeks 5–7

Day 1	Barbell Incline Dropset: Start with an approximate 6RM, rep out the weight, lower the weight by 20%, rep out the weight, etc. for a total of 5 max rep sets, resting only long enough to remove weight. Giant Set: (Dumbbell Bench Press x 12, Cable Uppercut Fly x 25, Push-ups x Max reps) x 3 Wide Grip Barbell Pullover: 3 x 25 reps Banded Incline Dumbbell Fly x 4 x 10 Crunches 3 x 20 reps
Day 2	Wide Grip Lat Pulldown: As many sets of 8 as possible while resting 30 seconds between sets. Use a 12RM load. Dumbbell Seal Row: 4 x 12 Giant Set: (Trap Bar Deadlift x 6, Inverted Row x 12, Wide Grip Pullups x Max reps) x 3
Day 3	Sprints @ 90%–95%: 40 meters x 10 reps; 30-second rest
Day 4	Arnold Press 6 x 10 Giant Set: (Chain Front Raise x 12, Cable Lateral Raise with 5-second eccentric x 8, Head-Supported Rear Delt Fly, holding contraction for 2 seconds x 12) x 3 Reverse Pec Deck: 6 x 15 Jump Rope: 40 seconds on/20 seconds off for 8 minutes Stability Ball Crunches x 3 x 20
Day 5	Hatfield Squat: 3, 6, 10, 20 reps Unilateral Leg Extensions (hold top for 2 seconds) x 4 x 12 reps Superset: (Leg Press x 15, Leg Curls x 8) x 4 Donkey Raises: 6 x 15
Day 6	Superset: (Reverse curls with 8-second eccentric x 6, Seated Tate Press x 25) x 3 Seated Zottman Curls with 5-second eccentric: 4 x 8 Decline Rolling Dumbbell Triceps Extension: 4 x 30 reps Banded Preacher Curls with 2-second hold halfway up: 4 x 6 reps
Day 7	Sprints @ 90%–95%: 40 meters x 12 reps, resting 30 seconds

Week 8 – Deload week

Weeks 9–11

Day 1	Banded Dumbbell Bench Press: 5 x 12 Giant Set: (Barbell Bench Press x 15, Incline Dumbbell Fly x 15, Standing Cable Fly x 40) x 3 Dumbbell Pullover: 5 x 20 reps Crunches 3 x 20 reps Jump Rope: 20 seconds of full speed/ 20 seconds of rest for 8 minutes
Day 2	Wide Grip Pullups: 200 reps (max reps, rest 15 seconds, until all 200 reps are completed) Snatch Grip Deadlift: 3 x 12 reps Straight Arm Lat Pushdowns: 5 x 20 reps One Arm Cable Low Row: 4 x 12 reps Seated Dumbbell Shrugs: 4 x 12
Day 3	Sprints @ 90%–95%: 40 meters x 10 reps; 20 seconds of rest
Day 4	Machine Shoulder Press Dropset: Start with an 8RM. Drop 15%–20% each time for a total of 5 max rep sets. Giant Set: (Rear Delt Swing x 30, Single-Arm Lateral Raise x 10, Scotts Press x 15) x 3 Reverse Pec Deck: 4 x 30 reps Jump Rope: 40 seconds on/15 seconds off for 8 minutes Stability Ball Crunches x 3 x 20
Day 5	Hatfield Squat: 3 x 20 reps Keystone Dumbbell Deadlift: 4 x 25 reps Giant Set: (Lunges x 40 meters, Calf Raises x 25, Leg Press x 20) x 3
Day 6	Incline Cable Curls: 4 x 12 reps Standing Cable French Press with rope attachment: 4 x 15 Machine Bicep Curls: 200 reps. Max reps, rest 15 seconds, max reps, etc. until all reps are completed Cable Triceps Pushdown with bar attachment: 200 reps using the same protocol as above
Day 7	Sprints @ 90%–95%: 40 meters x 12 reps, resting 20 seconds

Week 12 – Competition

A FEW LAST WORDS

Optimizing recovery, maximizing gains, and peaking at the right time come down to one thing: periodization. The smart bodybuilder will use exercises, methods, and routines that have been both empirically tested and proven to provide excellent results and a superior physique.

TOPICS COVERED IN THIS UNIT

Muscle Shaping

Stressing Different Muscle Parts

Isolation Exercises

Improving Symmetry and Lagging Body Parts

Increased Frequency

Working Origin and Insertion

Set Your Priorities

Breaking Out of Your Comfort Zone

BOSU Ball and Stability Ball Training

A Few Last Words

UNIT 10

BRINGING UP SYMMETRY AND ATTACKING WEAKNESSES

Massive, lean, and symmetrical muscle is all you want. For most bodybuilders, especially the novice, this can be accomplished simply by eating a clean diet and training heavy core lifts. However, as you continue to evolve, you will find that you need advanced techniques to increase gains.

MUSCLE SHAPING

Intense strength training and proper nutrition cause muscles to grow larger. But with a cessation of training and/or a caloric deficit, muscles can atrophy or decrease in size.

After a muscle is enlarged, can you control how it is shaped? Will exercise selection, volume, rep speed, and a mind-muscle connection literally cause a morphological change in muscle shape?

A majority of bodybuilders feel that they can shape their muscles to some degree. Popularized by muscle magazines, terms such as "mass exercises" are in fact basic compound movements, and "shaping exercises" are generally a single-joint movement performed in a peak contraction style. Others argue the opposite, with a stick-to-the-basics approach.

Who's right?

Training with maximal intensity and low repetitions in the one to five rep range with greater than 85% of a one-repetition max causes myofibrillar hypertrophy.

On the other hand, sarcoplasmic hypertrophy is an increase in the volume of the non-contractile muscle cell fluid, sarcoplasm. This fluid accounts for 25%–30% of the muscle's size. Even though the muscle increased in size, the density of muscle fibers per unit decreased, resulting in no increase in muscular strength.

Sarcoplasmic hypertrophy is induced through higher repetition ranges and a greater amount of volume. Powerlifters with minimal body fat have a much different look and appear to have a different shape than do bodybuilders with a similar percentage of body fat, despite that they weigh the same.

Genetics obviously are a major determinant in the aesthetics of a muscle. However, because the bodybuilder and powerlifter train differently, muscle can potentially look like a different shape, in part because the powerlifter's physique is largely the product of low rep training and increases in the contractile element of the muscle.

The bodybuilder who has fully developed a muscle will have up to 30% of his or her muscle developed from the non-contractile element. Another person with the same percentage of body fat and the same body weight could appear to have a different shape to the muscle as a result of training. Muscle shaping is not taking place; one is a maximally developed muscle, and the other is not.

STRESSING DIFFERENT MUSCLE PARTS

The "bro science" crowd is convinced that twisting your arm a certain way will develop a certain portion of the muscle, and the functional training crowd is convinced that muscles get bigger and smaller only, and that diet is the only reason powerlifters and bodybuilders are built differently.

The bro science" crowd is actually closer to reality on this one. For decades, science has known that certain heads of muscles function differently from one another, examples being the pectoralis major and the deltoids. Top exercise science researcher Bret Contreras (bretcontreras.com/) conducted a series of EMG studies that tested the electrical activity of muscle during exercise. Bret, unlike most researchers, is an avid bodybuilding fan and trains very seriously.

In e-mail correspondence, he reiterated, "You can trust my form was great in these experiments and

the data is good." Bret's work confirmed bodybuilders are correct, that various exercises can stress different parts of muscles. He said, "My research indicates that muscle fibers within a muscle can function differently from one another even if they don't have separate heads. For example, during my research I noted that the upper rectus abdominis and lower rectus abdominis function differently. I suspect this is true of all muscles." This would make sense because Contreras went on to point out that varying muscles many times have different points of attachments, numerous motor units, and sometimes varying nerve suppliers.

This has huge implications for the bodybuilder. That's why merely sticking to the basics you cannot maximally develop a muscle, hence the problem with high-intensity training and the lack of exercise selection. Implementing various exercises that attack the muscles at various angles, different cadences, rep ranges, and volume prescriptions is the only way to maximally develop a muscle.

When all elements of a muscle are fully developed and body fat is minimized, a muscle will appear different from when there is excess body fat and partial development. Twelve weeks of performing 10 sets of 10 reps lateral raises and 10 sets of 10 reps front raises will produce a different effect on deltoid musculature than will performing 10 sets of 10 reps in the overhead press for the same duration. This is because these exercises emphasize different degrees of fiber recruitment even though they target the same muscle group.

Even exercise technique plays a role in development of muscle: Performing dips with a forward lean and elbows out will place more stress on the pecs than a more upright posture will. Fred Hatfield said 30 years ago:

In the final analysis, after a muscle has been developed to its maximum, the shape of a muscle is genetically predetermined. Bodybuilders who have succeeded in developing all of the components of all the muscle cells in the biceps, for example, can only hope that the good Lord, in His infinite wisdom, gave him the genes necessary for the biceps to be well formed aesthetically.

Hatfield was right, but few bodybuilders are close to maximum development!

Isolation Exercises: Exercises that include only one limb and a limited number of muscles.

ISOLATION EXERCISES

Muscles and joints work together synergistically to perform movement patterns and produce force; muscles are not designed to work in isolation.

Take a look at the leg extension: Real-life movement patterns do not

isolate the quads and remove contributions of other lower body muscles. This is the functional trainer's argument against the implementation of isolation exercises. From a functional-movement standpoint, the argument seems logical.

But from a muscular-overload standpoint, the functional trainer justifies the bodybuilder's need for isolation exercises. Muscles do not work in isolation; by forcing them to do so with single-joint movements, overload is occurring. Overload is what we are after in training.

The average person on the street can produce a respectable imposing physique with primarily core lifts only. The bodybuilder is in a different situation.

Bodybuilders need unnatural development in certain areas that will take more than when overloading natural movements. The medial or side delts, with presses alone, will generally not develop the "capped" look that wins shows.

Arm development is huge in bodybuilding, and regardless of what you read on the Internet, at some point it will take more than heavy presses and chin-ups to maximally develop arm musculature.

When targeting the quadriceps, the sweep, or "vastus lateralis," is tough to develop with squats alone; leg extensions will provide a huge overload to "unnaturally" overload this area.

Olympic lifters perform many deep high bar squats and front squats in training and many times have the vastus medialis or "tear drop" development bodybuilders are after, yet they lack the sweep of a bodybuilder. This is because Olympic lifters never go near a leg extension machine, as deep Olympic squats sufficiently meet their needs. However, for the bodybuilder, some body parts need supernatural development that can only be accomplished with unnatural isolation techniques.

Check your ego at the door when performing isolation exercises. Complete isolation is impossible, but do your best. Synergist and stabilizer muscles may be somewhat involved, but make an effort to place the load on the appropriate muscles.

This is done with muscle intention, which means purposeful contraction of the muscles being worked. Involving your ego by using copious amounts of weight will quickly turn the movement into a pseudo-compound movement; if you lift excessive weights you have placed on a single joint, the movement can become unsafe.

When you perform a core movement, the weakest muscle group will limit the amount of weight that can be lifted. Picture this scenario: Your lower back is strong enough to deadlift 500 pounds, but your glutes lack the strength to lock the weight out. What's the result?

Best-case scenario, a missed lift; the worst-case is an injured hamstring caused by synergistic dominance. In other words, your hamstrings, which should be assisting your glutes in locking the weight out, take over because of the glutes' deficiency, and injury results. Isolation exercises can even help bring up the strength of a lagging muscle group that is not getting enough work because of overcompensation movement patterns.

Isolation exercises should be used year-round. In the off-season, two-thirds of movements may be compound, and a third might be isolation. As a contest approaches and you want muscles to really pop and look defined, the percentage may reverse itself. When putting on mass, generally, you are also targeting specific areas, this occurring via isolation exercises.

IMPROVING SYMMETRY AND LAGGING BODY PARTS

You are big, you are ripped, but symmetry is lacking; one arm may be smaller than the other, or a muscle group might be lagging. Have no fear, friends!

Let's look at some strategies to eliminate this haphazard problem.

Unilateral Exercises: Training one limb at a time.

Unilateral exercise research has conclusively shown that unilateral resistance training (one limb at a time) forces your body to recruit more muscle fibers than bilateral resistance training does. It requires much more effort for one limb, working by itself, to move a weight from one point to another, than for two limbs working collaboratively to move the weight the same distance.

The sum of the force that two independent limbs are capable of producing being together is less than is adding the maximum force together that one limb can produce. This is known as the bilateral deficit. Exceptions are highly trained powerlifters and Olympic lifters whose sport is to lift maximal weights bilaterally. Unilateral training takes advantage of the bilateral deficit.

How many people have one limb that is weaker than its respective counterpart is?

Most people fall into this category.

Performing an exercise unilaterally many times is a great way not only to identify a specific weakness or imbalance but also to mitigate it! If you are doing an exercise using only your left arm, your right arm cannot overcompensate and assist in balancing the weight and/or helping the lift. If your left arm is lagging behind your right arm in development, this must sound intriguing to you to say the least.

One great strategy to bring up that left arm is to perform exercises unilaterally.

Let's say we are focusing on the triceps: Overhead dumbbell triceps extension is the exercise of choice. Pick a weight at which you can do 10–15 repetitions with the left arm, do this weight to momentary muscular failure, and match the same amount of reps on the right arm (strong arm). Although the volume is the same on both arms, the intensity—the most important ingredient to growth—is maximally stressed on the weaker arm. This will help bring balance, but not at the expense of weakening

and atrophying the arm, as more traditional strategies do.

If you completely ignore the good side, generally the result is two bad sides. The same strategy can be used for other body parts: For the quadriceps use one-leg extensions, for hamstrings use one-leg curls, and so on.

Unilateral exercise variations can also be great for increasing metabolic stress on muscle by increased time under tension (TUT), pressing exercises for instance. Instead of performing a traditional incline dumbbell bench press, perform each arm independently. As you press with one arm, hold the other arm in extension; as you hold the non-pressing arm isometrically in extension, focus on contracting that pec; the other will take care of itself by lifting the weight. You can use close to the same amount of weight this way, potentially identify and eliminate imbalances, thereby literally doubling your time under tension. Very exciting!

INCREASED FREQUENCY

The Dark Ages are over, although many still prescribe to the notion that a muscle group can only be worked one day a week and that there is no other way.

"Comparison of 1 Day and 3 Days per Week of Equal-Volume Resistance Training in Experienced Subjects" was a landmark study published in the *Journal of Strength and Conditioning Research* in the year 2000.

The study compared one day versus three days of weight training weekly, with the training volume the same. There were two control groups: Group 1 lifted one day per week for three sets to failure (1DAY) and Group 2 lifted three days per week of one set to failure (3DAY). The 1DAY group achieved only 62% of the one-rep max increases of the 3DAY group in both upper body and lower body lifts! Muscle mass increases were greater in the 3DAY group. This study showed that a higher frequency of resistance training contributed to increased better strength and mass gains.

For a lagging muscle group, the answer can be increased frequency. This can entail two to three extra sessions a week that focus on the lagging body part. These sessions are submaximal; your muscles will recover. My concern is your central nervous system and joints, so be careful.

Let's say your lats are behind in development. If this is your current split,

Monday: Chest
Tuesday: Arms
Thursday: Back
Friday: Shoulders
Saturday: Legs,

then Monday/Saturday, in a separate session or mixed within your workout (if you cannot train twice a day), do lat pull-downs with cables on your knees (3 sets of 12 reps @ 70% intensity), straight arm pull-downs (3 sets of 12 reps @ 70% intensity), and wide grip pull-ups (3 sets of 8 reps @ 70% intensity). These extra sessions would be with submaximal intensity, no accommodated resistance, or any type of eccentric overloading.

Over the course of 12 weeks, instead of working your back 12 times, you have done so 36. In the process, you have not fatigued your CNS or sacrificed other workouts because of the low intensity. The idea, as Lee Haney once said, is "stimulate, don't annihilate."

Many professors will say that it takes about 48 hours for a muscle to recover from an intense workout. This is an incredibly simplistic notion; doing a German volume squat routine (as discussed in the next Unit) will take much longer to recover from. Sneaking in a few extra sets of

submaximal lat pull-downs will take less. Think about it: does it take 48 hours to recover if you walk to get your mail? Of course not. Recovery is relative. Consider giving submaximal high frequency training a shot to bring up a lagging body part.

Electromyostimulation (EMS): EMS incorporates the use of electrical current to activate skeletal muscle and initiate contraction.

Electromyostimulation (EMS) was a staple the Soviet sports machine regimen. EMS incorporates the use of electrical current to activate skeletal muscle and initiate contraction. In clinical/rehabilitative settings, EMS is commonly used. The beneficial effects of EMS are nearly universally accepted in today's world, but what about to the healthy bodybuilder seeking to bring up a lagging muscle group?

In the book *Supertraining,* Mel Siff, who has studied EMS extensively, offers these four uses for EMS to the strength and conditioning communities: (a) the invoking of physical stress to induce supercompensation (this could be increased strength, muscles mass, or explosive power), (b) restoration after injury or training, (c) neuromuscular stimulation for movement patterning, and (d) general endocrine restoration after intense exercise or injury. The recuperative benefits of EMS are covered in Unit 14. At this time we'll examine its effect on muscle hypertrophy.

Fred Hatfield has suggested applying electrostimulation to the muscle you are trying to bring up because each individual muscle cell has its own excitation threshold, the level at which it's stimulated to contract. Some are easily stimulated with as little as a couple of millivolts of "juice" from your central nervous system. Others, especially the high-threshold motor units, need as much as 15–20 millivolts of electrical current to stimulate them to respond contractively.

EMS recruits fast-twitch muscle fibers first, counter to the size principle. Theoretically, then, EMS will be more beneficial in bringing up a primarily fast-twitch muscle group like the triceps over a slower-twitch dominant one like the soleus. The idea is this: If a muscle group is lagging behind, it's important to get maximum excitatory stimulation to force previously unreached muscle fibers to contract. By doing this, a lagging muscle can potentially be brought up or create proportion between limbs.

What do studies say?

A 2005 French study, whose results were republished in English by the American College of Sports Medicine in its *Medicine & Science in Sports & Exercise* journal, set out to investigate the effects of four and eight weeks of electromyostimulation (EMS) training on both muscular

and neural adaptations of the quadriceps. The results were astounding: A 27% increase was seen in strength of the quadriceps, and the size increased by 6%. This was without pounding the pig iron, just EMS. Studies on advanced bodybuilders are scant, but to maximize your development, it is important you be aware of the tools at your disposal.

WORKING ORIGIN AND INSERTION

A muscle has an origin and insertion: The origin is the part that does not move, whereas the insertion is the part that does move. To fully develop a muscle, you need to attack both muscle functions. One way is to select exercises that do both. Charles Poliquin proposed origin/insertion supersets. For the biceps, the example Poliquin cited was close grip chin-ups supersetted with incline dumbbell bicep curls.

When you do a chin-up, the elbows remain in a fixed position while the shoulders literally move through air. On an incline dumbbell bicep curl, the opposite takes place; the shoulders are stationary, and movement occurs at the elbow. Triceps could be targeted by performing uprights dips and standing French presses. For quadriceps, a good combination is front squats and leg extensions.

For the chest, a push-up and dumbbell bench press could be used because, with a push-up, the arms remain stationary, and the torso moves. With a dumbbell bench press, the opposite takes place. For the back, the same could be done with a lat pull-down and a pull-up.

Notice that all these examples are an open kinetic-chain exercise coupled with a closed kinetic-chain one. You need to hit the muscle at a variety of angles through a variety of exercises.

SET YOUR PRIORITIES

A common joke in the fitness industry is that Monday is National Chest Day. Bench presses are occupied like a war zone, but squat racks resemble a ghost town.

Why is this?

Priorities!

Chest is a "beach muscle" extremely important to the lay gym population. But legs? Not as much. As a bodybuilder, you must not fall into this trap. While some guys desire development of certain muscles over others, the complete bodybuilder wants a complete symmetrical package.

Setting priorities doesn't just mean working what is most important at the beginning of the week; it takes a bit of creativity and planning.

For example, say on Wednesday you work four hours, but every other day you typically work twelve hours. Chest is your best body part, and legs are your weakest: what's the solution? Surely by now you have figured out it isn't hitting chest on Wednesday! You will be freshest on Wednesday, so train legs then.

BREAKING OUT OF YOUR COMFORT ZONE

Many people will interpret this as "go hard or go home," but this is not what's meant. Some people only know one speed: full speed.

Sometimes doing a deload, working out with less intensity, will be needed. Don't skip the workout or go all out; do what you are supposed to do.

Even though you love to train hard and heavy, you may have always had an embarrassing weakness doing chin-ups. This does not mean that you should do endless sets of lat pull-downs

with cheating force to oblige your ego; go hit the chin-up bar!

Generally, the biggest challenge to breaking out of your comfort zone is training with a lack of intensity. If you want to maximize muscular development, you must understand that each training session needs to be completed with an intention and that certain training periods require maximum intensity.

BOSU BALL AND STABILITY BALL TRAINING

Performing exercises on stability balls and BOSU balls has increased in popularity over the past decade. Not only have fitness folks and athletes implemented these techniques, but also they are now somewhat common in physique and strength athletes.

Do these techniques have a place in your program if you hope to pack on serious muscle? Some in the fitness industry believe that they should be incorporated, whereas others argue that there is no place in a serious bodybuilder's training program for these techniques.

Fortunately, studies have been performed on this subject, so let's take a look at what has been found.

Recently, James Kohler of California State University, Northridge (CSUN) led a study showing that training on stable surfaces overloaded and best recruited core muscles.

Both prime movers and stabilizers were assessed. Thirty resistance-trained subjects performed both barbell and dumbbell shoulder presses on stable and unstable surfaces for three sets of three, with what equated to equal intensity.

The same protocol was used for the bench press. Core muscle activation was measured by using electromyography (measurements of the electrical activity of muscles). As the instability of the surface increased, the recruitment of core musculature decreased.

Studies confirm that training on a stable surface is the most efficient way to load core muscles. Other studies substantiate this finding.

Athletes who are required to compete on unstable surfaces can consider occasionally training on them. However, these athletes are misinformed if they believe they are overloading their core. Because the goal of bodybuilding is packing on size and strength, there is no reason to train on an unstable surface.

A FEW LAST WORDS

A number of strategies have been outlined for you to maximize the development of uncooperative parts; use them. These strategies can be used in conjunction with the bodybuilding methods that are outlined in the next Unit.

If heavy bench presses aren't maximizing chest development, try the strategies that will be covered in the next Unit, such as a pre-exhaustion technique, rest pauses, drop sets, or a reverse pyramid. When traditional approaches aren't providing the results you want, be willing to break out of your comfort zone and to incorporate new strategies.

TOPICS COVERED IN THIS UNIT

Split System Training
Superset
Giant Sets
Rest-Pause Method
Drop Sets
EuroBlast Training
Staggered Sets
Traditional Pyramiding
Pre-Exhaustion Training
Post-Exhaustion Training
German Volume Training
20-Rep Breathing Squats
Forced Reps
Negatives (Eccentric Training)
Partial Reps
DC Training
Peak Contraction Training
Weider System/Principles
Heavy-Duty Training
Peripheral Heart Action Training
Circuit Training
Time under Tension (TUT) Training
Tempo Training
Powerbuilding
Compensatory Acceleration Training (CAT)
Muscle Priority Training
Cheating Exercises
Periodization Training
A Few Last Words

UNIT 11

BODYBUILDING METHODS AND TRADITIONS

"Bro science" is an anecdotal creed that emanates from bodybuilding circles. This creed has driven training methodologies for generations of iron disciples. Some of these methods are validated by scientific studies, whereas others need to be eradicated from the bodybuilder's regimen.

Let's take a look at a number of popular methodologies bodybuilders commonly use. Note that many of the methodologies discussed should only be used by advanced weightlifters who have been consistently resistance training for more than two years, demonstrate proper lifting technique, and are well conditioned.

SPLIT SYSTEM TRAINING

Split Training System: A type of training that divides training sessions by body regions, pushing and pulling days, antagonist body parts (muscles that oppose each other are trained in the same workout), or movement-based splits (in which one compound movement is performed each day). These are just a few examples of different splits, but the list goes on.

Superset: When two exercises are performed consecutively without a break

For beginners, entire-body training sessions are sufficient because they provide an ample stimulus for neural adaptation and trigger muscle growth. In fact, effective full-body sessions may consist of only one set per body part. However, the gains from full-body sessions taper off rather quickly, necessitating more advanced protocols.

Super Sets, Giant Sets, Rest Pause Sets, Drop Sets, Pyramiding, High-Volume Training and sets consisting of multiple movements, or triple sets, are used by bodybuilders to prompt more muscle growth.

Keep in mind that using these advanced tactics while engaging in full-body training sessions may be difficult due to the immense neural, mechanical, and metabolic demands placed on the body.

As such, a good idea is to shift your full-body training to split system training—a program of weight training that divides training sessions by body regions, movement patterns, or intensity prescriptions. This will allow for maximal muscle stimulation while permitting time for your body to recover.

If you decide to train the same exercises repeatedly throughout the week with a goal of accelerating neural adaptations, you could find yourself sacrificing intensity and working within percentages well below your one-rep maximum, thereby shortchanging any gains in hypertrophy or strength.

One classic program is the 5 x 5, which calls for performing five sets of five repetitions of the squat, bench press, and power clean, done three days per week.

Obviously you could choose to train each lift at full tilt during each session, but that would quickly lead to physical and mental burnout. Alternatively, you could fluctuate the training stresses throughout the week while still ingraining movement patterns, necessary to expedite neural

adaptations, by alternating heavy (H), medium (M), and light (L) days for each movement.

That would look like this:

Monday	Power Clean (H) Squat (M) Bench Press (L)
Wednesday	Power Clean (M) Squat (L) Bench Press (H)
Friday	Power Clean (L) Squat (H) Bench Press (M)

Now neural adaptations can readily occur without running the risk of overtraining. Although the split may not be divided by body part, intensity is cycled or waved, which breaks up the training stimulus in a sensible manner. You can easily adapt the aforementioned outline to any series of lifts on a three-day-per-week training split.

Training splits can be arranged in a countless number of combinations. Another popular split, adapted from old-school college football strength and conditioning programs, is the push/pull system, broken down by training pressing and squatting movements one day and training pulling movements, which would include pull-ups, rows, and deadlifts, on the other day.

A time-efficient twist to the push/pull system is to combine the movements in the same session and perform them as supersets throughout the workout. A pushing movement would be paired with a pulling movement.

Examples include:

- Vertical Push Movement (Military Press) superset with Vertical Pulling Movement (Chin-up)
- Horizontal Pushing Movement (Bench Press) superset with Horizontal Pulling Movement (T-Bar Row)

Seemingly infinite combinations of training splits can be designed. Commonly employed splits include body-part training splits, in which only one or two muscle groups are targeted each workout; antagonist body-part splits, in which muscles that oppose one another are trained in the same workout; and movement-based splits, in which one compound movement, such as a squat, bench, or deadlift, is performed each workout.

Splits may also consist of training to failure, such as high-intensity training, or they may emphasize phases of muscular contractions to induce more muscle growth. The realm of possibilities is practically endless.

Regardless of what split you choose to follow, it is imperative that you adhere to proven training principles. You must maximize energy levels for individual workouts and know that the results of a training program are the sum of individual workouts. When things are done right, the outcome is greater than the sum. In other words, synergy takes place and puts you on the road to building a championship physique.

SUPERSET

A superset is when two exercises are performed consecutively without a break. Originally, supersets were defined as combining two exercises of antagonist (opposing) muscle groups. An example would be a biceps curl immediately followed by a triceps extension.

A extremely popular method of supersetting, because of its emphasis on proper postural alignment and the elimination of muscle imbalances, is the push/pull superset system. This could be a horizontal or vertical pressing movement followed by a horizontal or vertical pull movement. An example would be a bench press paired with bent-over row or a military press paired with a

chin-up. The obvious benefit is that symmetrical development of opposition muscle groups is enhanced. This system is more intense than the traditional set system is, which is when one set of an exercise is performed, followed by rest, followed by another set of that same exercise. Arnold Schwarzenegger popularized supersets with the idea being "More work could get done in less time."

Here are some practical examples of traditional supersets:

Legs	Leg Extensions / Stiff Leg Deadlifts Sissy Squats / Leg Curls
Chest, Shoulders, and Back	Flat Benches / T-Bar Rows Military Press / Chin-ups Front Raises / Face Pulls
Arms	Close Grip Bench Press / One-Armed Eccentric Barbell Curls Tricep Push-downs / Scott Curls

In today's world of bodybuilding, the term superset is sometimes used differently from its original intent. Frequently, it is used to describe a single-joint (isolation) movement paired with a multi-joint (compound movement) for the same muscle group.

A popular chest superset would be a pec deck and a bench press. Some of our more artistically inclined bodybuilding brethren perform two movements for the same muscle group with different emphasis. An example of this would be the incline press supersetted with a weighted dip. The incline press would be for the clavicular portion of the pectoralis muscle group (upper chest) and the dips for the sternal aspect of the same muscle group (lower chest).

Examples of within muscle group supersets:

- Quadriceps from Different Angles
- Leg Extensions and Hack Squats
- Upper Back from Different Angles
- Chin-ups and Seated Rows
- Shoulders from Different Angles
- Lateral Raises and Overhead Presses

Giant Set: Combining three (or more) exercises without resting between exercises

Rest-Pause Method: Rest-pause training breaks down one set into several mini-sets, with a brief rest between each.

GIANT SETS

As we climb our way up the mountain of intensity, we step into the land of Giant Sets. A Giant Set consists of combining three exercises and sometimes even more without resting between exercises.

A Giant/Tri Set, in its original intention, would be used to develop individual muscles within groups consisting of three or more muscles. An example would be lateral raises, inverted flyes, and front raises. These three exercises would work the three heads of the deltoids (lateral "side," posterior "rear," and anterior "front") as independently as possible.

Here are some examples of Giant Sets:

- Quadriceps at Different Angles
- Leg Extension, Sissy Squats, Front Squats
- Chest at Different Angles
- Chain Flyes, Chain Bench Press, Bench Presses
- Triceps at Different Angles
- Triceps Push-downs, Upright Bar Dips, Barbell Triceps Extension, Triceps Extension
- Back at Different Angles
- Chin-ups, Dumbbell Rows, Reverse Hyper Extensions

REST-PAUSE METHOD

Rest-pause training breaks down one set into several mini-sets with a brief rest between each. Depending on the intensity level and what you hope to accomplish, several different methods can be used.

For strength, this involves taking a single at 85%–95% of your one-repetition max, then waiting 15–30 seconds, and then performing another single with the same weight and repeating this process until failure. Typically, six to eight singles can be done. This method is extremely taxing on the central nervous system and can be dangerous. Generally, the adaptations are more neurologically driven for strength than for increases in muscle hypertrophy.

We must remind ourselves that muscle mass is our ultimate goal as bodybuilders. Many old-time strength aficionados swear by this method, and it has certainly worked for some. But with everything we do in training, we must weigh the risks and benefits. Proceed with caution when experimenting with this method.

An example of this type of training on the bench press, for someone with a one-repetition of max 300 pounds, would be to use 275 pounds, rest 15 seconds, keep repeating, and stop after failure.

A more effective variation of this method can be used for the bodybuilder seeking muscle hypertrophy. Select your chosen exercise and select a weight you can perform for six to ten repetitions, lift the weight to failure, stop and rest for 15 seconds, and do the same weight again to failure; this will probably be two to three repetitions. Repeat this process once or twice; it is very tough to go beyond three sets.

If you select the bench press as your exercise, a rest-pause series with an emphasis on hypertrophy might look something like this:

Set 1	225 x 8 reps
Rest	15 seconds
Set 2	225 x 3 reps
Rest	15 seconds
Set 3	225 x 2 reps

This method is a great way to bust through a plateau and teach you to grind out reps. Your muscle fibers will be very fatigued and, because of the short repetitive bout, you will build a fantastic mind-muscle connection and experience an extensive muscle pump.

This is extremely taxing on the central nervous system (CNS); do not use this method every workout or for multiple sets of the same exercises

or movements. Because of the method's strain on the CNS, avoid doing this for highly technical movements.

Recent research provides some interesting findings on the effectiveness of the rest-pause method.

A study was published in *Journal of Science & Medicine of Sport* that consisted of 14 subjects who performed three resistance training protocols involving 20 repetitions in the squat with 80% of their current one-rep max. The first training protocol consisted of five sets of 4 reps with three-minute rest intervals. The second program consisted of five sets of 4 reps with 20-second rest intervals. Finally, the rest-pause method consisted of the initial set to failure, and then subsequent sets were completed after a 20-second rest interval.

All training methods had similar decreases in maximal force and rate of force development post workout; however, increased motor-unit recruitment was observed following the rest-pause protocol.

DROP SETS

Drop Sets: A technique in which you rep out a weight, quickly reduce the weight, lift again to failure, etc., for the desired number of drop sets.

Drop sets are an effective method for packing on slabs of muscle. However, they too place a tremendous strain on the central nervous system.

Drop sets should be used sparingly because it is easy to overtrain with this method. If you decide to use drop sets in your training program, one to two per workout likely won't have negative side effects. But if you use week in and week out in a training cycle, central and peripheral fatigue will quickly accumulate. Residual fatigue from prior sessions will inhibit your body's ability to recover and will severely affect CNS functioning.

The purpose of drop setting is to provide a "shock" stimulus to the muscles by placing much more additional stress on a muscle than a traditional set does, inducing a higher degree of muscle hypertrophy.

Drop sets work simply because they recruit the entire spectrum of muscle fibers, ranging from the powerful fast-twitch fibers down to the slow-twitch oxidative fibers.

Fast-twitch fibers are worked from the initial heavy weight, and the slow-twitch muscle fibers are worked from the final high repetitions. Because of the overall volume of blood that moves to the muscle group being trained, bodybuilders will experience an amazing pump, filling the area being worked with oxygenated, protein-enriched blood, setting the stage for newfound muscle growth.

Traditionally, drop sets have been used as a way to continue exercise with a lower intensity once muscular failure has been achieved at a higher intensity.

Muscular failure is critical to making muscles grow because it stimulates the release of growth hormone (GH) and insulin-like growth factor-1 (IGF-1). Many bodybuilders opt to perform their drop sets on plate-loaded or selectorized machines, as this is relatively safer and because it allows bodybuilder or workout partners to quickly reduce the load, either by shedding plates or by adjusting the pin along the weight stack. Some ambitious bodybuilders use drop sets with barbell and even dumbbell exercises.

I have taken this a step further and included some optimal leverage and accommodating resistance drop-set techniques.

An example of a dumbbell drop set would be the rack and run technique. Let's use lateral raises as an example.

If your top set of lateral raises with dumbbells is 30 pounds, you would perform this weight until failure. Next, you would do the same thing with 25 pounds, then 20 pounds, then 15 pounds, then 10 pounds, and finally 5 pounds. You run down the dumbbell rack from your top set to the lightest weight on the rack.

Barbell drop sets are usually associated with the strip set, meaning you have small plates on the barbell and, once muscular failure is reached, you strip one of the plates off and continue.

An example would be doing biceps curls with 105 pounds, which would be a 45-pound bar with three 10s on each side; curl this weight until failure. Then your partners immediately strip a 10-pound plate off each side. Then you do 85 pounds until muscle failure. Repeat the process and then it is 65 pounds until failure. You could continue this all the way down to the 45-pound Olympic bar.

Accommodated resistance drop sets entails performing a traditional exercise with the addition of bands or chains.

Let's use the bench press as an example, with 200 pounds of weight on the bar with an additional 100 pounds of chains (two 25-pound chains on each side). Complete the maximum repetitions with the two chains on the bar, racking the bar upon failure, and have a partner pull one chain off each side of the bar. Next, complete the maximum amount of repetitions with 200 pounds on the barbell and 50 pounds of chains. Upon failure, remove the last pair of chains. Finally, complete the 200-pound bench press with straight bar weight.

Mechanical advantage or optimal leverage drop sets, unlike traditional drop sets, do not include a reduction in weight after each set; instead, the drop is an improvement of leverage.

Let's use the incline dumbbell press as an example. Start with the incline at 60 degrees and perform the exercise to failure. Next set, drop the adjustable incline bench to a 40-degree angle and perform the incline dumbbell press to failure. Finally, drop the incline to 20 degrees and perform the exercise to failure.

Unlike traditional drop setting in which weight is reduced, this method improves leverage, so as you grow tired, your leverage improves. It is a different way of manipulating intensity than just reducing weight is.

Generally, drop sets are reduced in weight/intensity 10%–30% per drop, and two to three drops are performed. Again, remember to use these methods with caution!

This is just the tip of the iceberg. Be creative, experiment, and learn.

EuroBlast Training: This type of training consists of pumping the muscles in different ways and suffusing the body part you are working with massive quantities of blood and nutrients that muscles need.

Staggered Sets: Stagger your smaller and slower developing body parts between sets for larger muscle groups, such as doing a set of wrist curls or concentration curls between sets of leg presses or squats.

Traditional Pyramiding: Involves performing sets consisting of high reps at the beginning of the workout (base of pyramid), working toward the top of the pyramid by decreasing reps and increasing weight.

EUROBLAST TRAINING

The EuroBlast focuses on pumping the muscles in different ways and suffusing the body part you are working with massive quantities of blood and nutrients that muscles need. And it's not just doing a regular barbell curl, in the regular way, until the arm gets tired and pumped.

You want to use the EuroBlast in different ways, and here are a few of them:

- Pick one exercise and do only one set and don't count reps. Simply keep the weight moving up and down until that body part reaches peak pump.
- When using it on the last exercise in a series of multiple sets and exercises for a body part, do short-range reps (moving the weight only 3–6 inches up and down) and keep doing those short-range reps until the muscle is no longer able to move the weight.
- Use forced reps with a partner whereby the partner helps you—after you've reached muscular failure—do 5–7 more reps; then you rack the weight and your partner strips off at least 40%–60% of the weight, and you do another 5–7 reps with your partner's help.
- You could even do two, three, or four of these "rack-and-strip-the–weight" pumping sets if you choose, whereby you'd have the partner strip off 20% of the weight for the first set, then take off another 20% on the second set, and then another 20% off for the third set until you've reached the 60% reduction. Ultra intense.

Remember, the key to the EuroBlast is to keep the muscle moving and pumping and the blood flowing.

STAGGERED SETS

This type of training is when you stagger your smaller and slower developing body parts between sets for larger muscle groups, such as doing a set of wrist curls or concentration curls between sets of leg presses or squats. This will allow you to train the bigger muscle group (legs, in this example) with plenty of energy and power while also working the smaller muscle (either forearms or biceps in this example).

Many times bodybuilders need to bring up a lagging muscle group, which may require as many as 40 sets per week for that particular muscle group. This cannot be done effectively in one workout, so increased frequency is needed. Staggered sets provide an excellent opportunity to increase frequency and get in those extra sets.

TRADITIONAL PYRAMIDING

Pyramiding involves performing sets consisting of high reps at the beginning of the workout (base of pyramid), working toward the top of the pyramid by decreasing reps, and increasing weight.

Starting with lighter weights gives your muscles and connective tissues a chance to warm up for the heavier weight later in the workout. As you increase weight, you overload your muscle fibers, and that induces muscle hypertrophy.

Pyramid training has the advantage of many variables that can be manipulated to increase intensity. And after all, increased intensity will increase muscle mass.

Let's look at this example of a pyramid squat workout.

Set 1	225 x 12
rest interval 3 minutes	
Set 2	245 x 9
rest interval 3 minutes	
Set 3	260 x 7
rest interval 3 minutes	
Set 4	275 x 5
rest interval 3 minutes	
Set 5	290 x 3

This variety of sets with a different number of repetitions used means there are countless ways to increase intensity.

If we reduce the rest interval by just 10 seconds, we have increased intensity.

If we add just one repetition to one of the sets, we have increased intensity.

If we add an extra set, we have an increased intensity. And of course we could just pile more pig iron on the bar.

Pyramids offer an abundance of ways to increase intensity, our ultimate goal, and this is something many haphazard training bodybuilders fail to track.

Many strength athletes have used pyramids for decades with success, and as bodybuilders, we must remember that our base is our limit strength!

The above example is a traditional ascending pyramid. The following are some variations of the traditional pyramid:

TRIANGLE PYRAMID ("EGYPTIAN PYRAMID")

In this technique, you work your way up (ascending) the pyramid and then back down (descending). Here is an example in the deadlift for someone with a max of 350 pounds:

Set 1	255 pounds x 8 reps
Set 2	285 pounds x 6reps
Set 3	315 pounds x 4 reps
Set 4	285 pounds x 6 reps
Set 5	255 pounds x 8 reps

Double Wave Loads

Here is an example in the bench press for someone who has a one-repetition max of 300 pounds. Using this method, you follow an ascending pyramid two times.

Set 1	200 pounds x 12 reps
Set 2	215 pounds x 10 reps
Set 3	235 pounds x 8 reps
Set 4	200 pounds x 12 reps
Set 5	215 pounds x 10 reps
Set 6	235 pounds x 8 reps

Reverse Pyramiding: The opposite of traditional pyramiding; the base is the heavy weight, and you increase reps and decrease weight as you work your way up the pyramid.

Pre-exhaustion Training - Using a single-joint "isolation" movement to failure before performing a heavier multi-joint "compound" movement is performed is called pre-exhaustion training. A practical example would be leg extensions before front squats (for the quadriceps) or cable flyes before the bench press for the chest.

REVERSE PYRAMIDING

As you just learned, traditional pyramiding is doing high reps at the beginning of the workout (base of pyramid) and, as you build your way up the pyramid, decreasing reps and increasing weight.

Reverse pyramiding is the opposite: The base is the heavy weight, and you increase reps and decrease weight as you work your way up the pyramid.

If you're burning yourself out on light weights and not giving yourself a chance to make strength gains, you're shortchanging yourself. I don't want to say traditional pyramiding is flawed, but if you need to build your base and you use this approach, you need to make sure you save enough energy for your heavier sets.

One reason some people have such effective results with traditional pyramid training is that their lighter sets are essentially warm-up sets. They are not burning themselves out; they are simply warming up.

Many college strength coaches purposely assign lighter sets that are not fatiguing prior to the heavy sets being performed because these coaches know the athletes will not properly warm up. With reverse pyramid training, a proper warm-up is essential.

Reverse pyramiding will allow you to build strength very effectively because the most important strength-building set is the first set in this rep scheme. Therefore, the athlete is 100% fresh.

Post-activation potentiation (PAP) refers to the enhancement of muscle function following a high-force activity.

Legendary Russian sports scientist Yuri Verkhoshansky explained PAP in layman's terms: "When you perform a 3–5 Rep Max followed by a light explosive set to your nervous system it's like lifting a half can of water when you think it's full." The weight feels lighter and moves faster.

When training heavy on a core lift, we are generally lifting the weight, if it is a work set, with maximal force. Most studies on PAP are generally conducted on things like heavy squats followed by an explosive activity like a vertical jump. Many studies demonstrate the effectiveness of PAP, but the same holds true when moving from a maximal weight to a submaximal weight.

I have used this strategy with people performing a bench press for maximum reps at a football combine. If the weight is 225 for maximum reps,

prior to performing a set of maximum repetitions at 225 pounds, the athlete will do a single repetition with a weight in the 275–315 range, rest for five to seven minutes, and then perform as many repetitions as that can at 225 pounds. Athletes can always do more reps this way—as opposed to warming up and making 225 the heaviest set.

No studies have investigated this particular method; however, anecdotal evidence suggests that you can generally perform a greater number of maximum repetitions if you lift heavier weight first. Of course, this is assuming you don't overdo it. Simply put, 300 pounds feels lighter if you have just lifted 400 pounds.

Reverse pyramiding can be used year-round. However, it would not be a good idea to do heavy singles, doubles, and triples year-round. There will need to be some variation in the intensity, sets, and reps schemes. That said, the concept can be used as long the variables that dictate intensity are properly manipulated.

Here is an example of a legs-oriented reverse-pyramid workout:

Legs, Bodybuilding Oriented	
Squats	3 (90%), 5 (85%), 8 (78 %), 12 (70%)
Squats	10 (bottom half), 10 (top half), 10 (full range of motion)
Walking Lunges	(per side) 6, 8, 10
Dumbbell Bulgarian Split Squats	(Tempo–5-0-3-0) 5, 6, 8
Leg Press	20, 30, 40, 50
Leg Extensions	(Tempo 3-0-2-0) 10, 12, 14
Leg Curl/Stiff Leg Deadlift Superset	(decrease weight in both movements each superset as reps increase) 6/8, 9/11, 12/15, 15/20
Abs	8 sets

PRE-EXHAUSTION TRAINING

Using a single-joint "isolation" movement to failure before performing a heavier multi-joint "compound" movement is performed is called *pre-exhaustion training*. A practical example would be leg extensions before front squats (for the quadriceps) or cable flyes before the bench press for the chest.

Arnold Schwarzenegger popularized this technique in the movie *Pumping Iron*. If you watched it, you'll remember Arnold's performing leg extensions before squats. Though a seemingly unusual practice, the idea behind pre-exhaustion training is this: When you fatigue the prime mover muscle with an isolation exercise prior to a heavier compound movement, you will foster greater muscle fiber recruitment because muscular fatigue will set in before neurological fatigue does.

Compound movements require a far greater degree of neuromuscular activity than single joint movements do. Theoretically, you'll get the best of both worlds by inserting pre-exhaustion training into your repertoire, as you'll recruit more muscle fibers, which will ultimately lead to much greater muscle growth.

Some prominent coaches and trainers believe pre-exhaustion training is more friendly to the joints, as muscular fatigue sets in prior to training heavy compound movements. Thus muscular fatigue can now be achieved using lighter loads yet still yield hypertrophic benefits.

All of this sounds great! But what does science have to say?

One 2003 study in the *Journal of Strength and Conditioning Research* conducted with 17 men showed the effect of pre-exhaustion training on lower-extremity muscle activation during the leg

press. Prior to performing the leg press exercise, subjects performed a 10-repetition maximum in the leg extension; then a 10-repetition maximum was performed in the leg press.

Muscle activation was measured using electromyography (EMG), which showed that activity of the quadriceps, or target muscle, was significantly less when subjects were pre-exhausted. Judging the muscle-building effect of an exercise requires more than an EMG reading, but the subjects were able to complete more repetitions and use more weight on the leg press when not in a pre-exhausted state.

The conclusion of this study was contrary to most bodybuilders' belief that pre-exhaustion training is an effective strategy for increasing muscle fiber recruitment.

A 2007 study in Brazil titled "Effects of Exercise Order on Upper-Body Muscle Activation and Exercise Performance," produced a similar conclusion. The study, which also used EMG, involved performing repetitions on the machine pec deck, prior to the bench press, in a pre-exhaust style.

The study demonstrated that the chest muscles were no more efficiently recruited using a pre-exhaustion technique, as EMG signals confirmed. The only muscle that had a higher EMG signal during the bench press was the triceps, and this was simply because the chest was fatigued, and motor units from the pectoralis region could not be as effectively recruited. This study concluded that if you want to become better at a particular exercise, perform it first in the training session.

Pre-exhaustion training will not lead to greater muscle fiber recruitment or even to greater joint safety for that matter. This is due to fatigue in the muscles that are normally used as prime movers during a compound movement; that alters the motor pattern of the compound movement, resulting in less efficient and even unsafe technical execution of compound lifting movements. The majority of pre-exhaustion training benefits are simply "bro science" and therefore should be used sparingly (if at all) in a training program.

Here as an example of a pre-exhaustion training for the chest:

Pec Deck	45 seconds max reps x 3 sets
Flyes	3 sets 12 reps, supersetted with Cable Upper Cut Flyes 3 sets 12 reps
Machine Press	3 sets 12 (last set 3 drop sets to failure)
Bench Press	4 sets 8 reps

POST-EXHAUSTION TRAINING

Just as you might have guessed, post-exhaustion training is the opposite of pre-exhaustion training; it is, in fact, how most powerlifters or power bodybuilders, also known as "powerbuilders," train.

Instead of the athlete pre-fatiguing the muscle with an isolation exercise prior to performing a heavy compound movement, the heavy compound movement is performed first in the workout, and the isolation movements are performed later in the workout.

The advantage to this type of training is that you will be freshest for the compound movement. After all, compound movements should serve as the base of your training, as they provide the most stimulation for muscle growth and evoke a significant hormonal response to training.

Training in this manner allows the lifter to concentrate on strength for the compound movement and to wrap up the workout with isolation movements for a nice pump.

Science confirms this training methodology as an effective one.

A 2012 article in the *Sports Medicine Journal* examined the sequence of resistance training exercises performed. This article looked at studies from every major academic database, including the Scielo, Science Citation Index, National Library of Medicine, MEDLINE, Scopus, SPORTDiscus~M, and CINAHL®.

Acute responses were examined, as were long-term adaptations, with resistance training exercise order as the experimental variable. It was found that exercise order affects max effort strength, the ability to perform repetitions over multiple sets and total volume.

Much greater strength gains were realized when compound exercises were performed first in a session, as opposed to their being performed at the end of a session.

The research concluded that exercises should be sequenced in order of neuromuscular demand. Placing compound movements first in an exercise program is supported generally by anecdotal observations of the biggest, strongest, most muscular men on the planet, so it isn't surprising to see science back this up.

Here is an example of a post-exhaustion shoulder workout:

Overhead Press	5 sets 5 reps
Arnold Presses	2 sets 10 reps
Lateral Machine Raises	3 sets 15 reps
Seated Dumbbell Lateral Raises	1 top set to failure, 3 rest-pause sets (15 seconds of rest)
Reverse Flye/Face Pull superset	12, 12 x 3 sets
Machine Shoulder Press	90 seconds of continuous tension (slow and light)

Post-exhaustion Training: This is the opposite of pre-exhaustion in which the heavy compound movement is performed first in the workout and the isolation movements are performed later in the workout.

German Volume Training: This is a training routine originally used by German weightlifters in the off-season to gain lean muscle mass. It consists of 10 sets of 10 reps with the same weight for each exercise. You want to begin with a weight you could lift for 20 reps to failure if you had to.

GERMAN VOLUME TRAINING

This method should probably be called the 10 Sets Method, but legendary strength coach Charles Poliquin has made it better known as "German Volume Training." It is believed to have originated out of German weightlifting circles by Coach Rolf Fesser as a program to add muscle in the off-season. Bill Kazmaier used this method in the bench press in the off-season, as did the author this textbook, Josh Bryant, the youngest person ever to bench press 600 pounds raw.

While Charles Poliquin popularized the system in North America, legendary bodybuilder and fitness trainer to the stars, Vince Gironda, used a similar method with his clients. Even Bev Francis used German Volume Training in her early bodybuilding days to pack on mass. A great

deal of anecdotal evidence suggests this method is highly effective.

Generally, a high-volume protocol of multiple sets of six to fifteen repetitions performed at 55%–85% 1 RM is prescribed to stimulate maximum muscle hypertrophy. Volume is defined as *reps x sets x poundage lifted*. My in-the-trenches experience would confirm that generally higher volume produces better muscular gains, as opposed to the same sets and repetitions using lighter weights. That's why compound movements are the method of choice for building muscle mass.

Let's look at an example in which our primary emphasis is the quadriceps using the front squat and the leg extension.

If four sets of 10 repetitions are performed on the front squat with 300 pounds, the total volume is 4 x 10 x 300 = 12,000 pounds. If we did the same workout with leg extensions using 60 pounds, the total amount of volume would be 4 x 10 x 60 = 2,400 pounds. Much more work is accomplished with the front squat, and this is the premise of German Volume Training.

Even though most educated coaches and athletes correctly use compound movements as their go-to choice to add muscle mass, generally, after the compound movement is performed, the goal is then to hit the muscle from all different angles.

This can be accomplished via supplementary core lifts (for example, performing a dumbbell military press after a standing military press) and, of course, multiple sets and repetitions of single-joint movements that more effectively isolate the muscle. As mentioned earlier, this technique is known as post-exhaust training or powerbuilding. The goal is to get the benefit of the core movement and also stimulate as many muscle fibers as possible by attacking the muscle from a variety of angles with a variety of movements.

What's the alternative? Attack the same movement with multiple sets, much higher than typically recommended.

Limited studies on German Volume Training confirm its effectiveness for building muscles.

In fact, a 2010 study published in the *Journal of Australian Strength and Conditioning* demonstrated that German Volume Training (GVT) protocol increased muscle mass in elite kayakers after using the system for five weeks. Other anecdotal reports support this notion and, of course, the endorsement of the German weightlifting machine doesn't hurt!

Originally, German Volume Training (the 10 Sets Method) was a protocol of 10 sets of 10 repetitions of a compound movement, using a 20-repetition max, or approximately 60% of the athlete's 1-rep max. Rest periods of 60 seconds up to three minutes have been advocated; however, rest depends on the movement being performed, the load used, and the anaerobic capacity of the athlete. In the event of not being able to complete all the repetitions, reduce the load by 2.5%–5%. Thus, if you were using 200 pounds and did not complete the final rep on the seventh set, use 190–195 pounds on the following set.

Although this reduction is quite small, we want to keep the intensity as high as possible for maximum muscle growth. If you attempt to keep the weight the same and continually miss reps because of fatigue, you won't reap GVT's intended benefits.

If you are performing only 4 reps on your last set, even if you had made every rep until that point, you have reduced the total volume by 60%! If you do this over multiple sets, you have significantly deviated from the protocol, which will greatly alter the adaption to the program. German Volume Training is 10 sets of 10 repetitions. If you decide to use this method, stick to it!

HOW DOES GERMAN VOLUME TRAINING WORK?

Because of the high-volume training load, short rest intervals, and moderate load, this method produces an extremely anabolic natural growth hormone response.

The idea, as Poliquin has written, is to attack the same muscle fibers repeatedly with the same movement for extremely high volume, and this will force the muscle fibers to experience major growth.

This occurs by doing multiple sets: Your fatigued muscle fibers no longer are recruited; instead, new ones will be called to action, equating to more growth. The idea is that fast-twitch and growth-resistant slow-twitch fibers will both experience growth from this demanding regimen.

Powerlifters have used a similar approach with much lower reps with the same idea and have become neurologically efficient in the competition lifts.

Many strength coaches now advocate supersetting German Volume Training with an antagonist muscle movement, so for the bench press, this could be a dumbbell row, or for the overhead press, this could be a chin-up.

Australian strength coach Dan Barker recommends a three-minute recovery between each superset complex. For well-conditioned athletes, an abdominal exercise could be added into the complex, so a complex could be shoulder press–chin-up–leg raises (rest three minutes, repeat 9 more times).

Performing squats or deadlifts entails core involvement and massive loads, so it would not be wise to add an abdominal exercise. Because of the neuromuscular complexity, it is not recommended to use Olympic lifts or their variations for German Volume Training.

PRACTICAL EXAMPLES OF GERMAN VOLUME TRAINING

Complex 1		
1a	Bench Press	10 sets 10 reps
Rest 20 seconds before 1b start @ 60% 1-rep max		
1b	Inverted Row	10 sets 10 reps
Rest 20 seconds before 1c; if bodyweight becomes too difficult, go band assisted		
1c	Leg Raises	
Rest 3 minutes before repeating the complex		

Complex 2		
1a	Overhead Press (OHP)	10 sets 10 reps
Rest 20 seconds before 1b start 60% 1-rep max		
1b	Chin-ups	10 sets 10 reps
Rest 20 seconds before 1c; if bodyweight becomes too difficult, go band assisted		
1c	Leg Raises	
Rest 3 minutes before repeating the complex		

Complex 3		
1a	Squats	10 sets 10 reps
Rest 20 seconds before starting 1b start, use 60% 1-rep max		
1b	Glute Ham Raises	10 sets 10 reps
Rest 3 minutes before repeating complex; if bodyweight becomes too difficult, go band assisted		

Besides causing muscle hypertrophy, German Volume Training can benefit the cardiovascular system. Daniel Barker and Robert Newton showed this to professional rugby players performing a German Volume Training bench press routine; by their last set, their heart rates had climbed to 160 beats per minute and never dropped below 120 during the recovery phase.

It would be interesting to see how high athletes' heart rates would climb when these athletes perform a German Volume Training workout with a squat or deadlift emphasis. Because of the cardiovascular demands, athletes with poor conditioning will not be able to effectively benefit from a German Volume Training routine.

20-REP BREATHING SQUATS

Athletes for have used the 20-rep breathing squat routine for more than 75 years. J. C. Hise gained nearly 100 pounds in 2 years using this routine; iron pioneer Mark Berry heavily influenced Hise.

Peary Rader, founder of *Ironman Magazine* and a self-described hard gainer, credits this routine with adding 100 pounds to his frame. Rader was the first to publish the 20-rep breathing-style squat routine. Breathing squats are done for 20 repetitions with a weight you would typically do for 10 repetitions. It is one all-out set! Each time you think you will fail, take 3–4 deep breaths and continue until you reach 20 reps. These sets should be a deeply painful and unpleasant experience. If you find that they are not, add some weight to the bar.

Rader advocated the Valsalva Maneuver (holding your breath) while performing the squat movement and to take deep breaths of air between reps. Begin with a weight that you can complete and add weight each session; the best gains will be made when the set of 20 reps is an all-out effort.

Initially, this breathing technique may make the weight seem more difficult to lift, but over time, as you familiarize yourself with this technique, you will actually be able to lift more weight for more reps this way.

This routine is not one for the faint of heart. A massive degree of mental toughness is required to squat an all-out set of 20 reps to full depth. Your mind will want your body to stop at 12 reps; this is where you really challenge your psyche. Don't focus on how many reps you have left; focus on the next rep breath and block out the voice in your head urging you to quit.

To reap the intended benefits of this protocol, you must perform with a full range of motion, going below parallel on every squat.

Let's say you used 225 for 20 reps all-out and it was a challenge. If you try the same weight with half squats during the next workout, it will not be a challenge.

If your full range of motion squat is 20 inches and you use 200 pounds, look at the amount of mechanical work you do: 200 x 20 = 4,000. Now, if you do a half squat, look at how that equation has changed: 200 x 10 = 2,000, not to mention the work your glutes and hamstrings are robbed of because of the insufficient range of motion and, of course, you spend less time under tension.

Here is the original 20-rep routine printed in *Ironman Magazine* in 1968:

Behind-the-Neck Press	3 x 12
Squat	1 x 20
Pull-Overs	1 x 20
Bench Press	3 x 12
Bent-Over Rows	3 x 15
Stiff-Legged Deadlift	1 x 15
Shrug	1 x 15
Pull-Overs	1 x 20

This routine would be performed two to three times a week, which would be a bit much for many trainees, especially without cycling in heavy, medium, and light days/exercises. Bodybuilders have used this routine on their leg days, doing an all-out set of 20 reps of breathing squats with more traditional lower body accessory work.

A routine like that would look like this:

Squat	1 x 20
Lunges	3 x 12
Leg Curls	3 x 6
Leg Ext	3 x 15
Calf Raises	4 x 20
Abdominal Work	

There have been no peer-reviewed studies on the 20-rep breathing squat routine, only the anecdotal reports of lifters who have claimed to gain massive amounts of muscle with this routine.

This routine was originally developed to help bodybuilders with bulking and was advocated with a very high-calorie diet and a gallon of

whole milk a day. When you work out only a couple of hours a week and drink seven gallons of whole milk weekly, you will gain weight. Regardless of the diet, I do not seek to downplay this routine's effectiveness. It is simply important to consider all the variables at play.

FORCED REPS

We talk a great deal about the risk-to-benefit ratio. Forced reps offer a huge benefit when properly implemented. However, you run the risk of overtraining when using this system of training too frequently because of the ultra-high intensity and the trauma-to-the-muscle experience. Forced reps propel you past your pain threshold. Some believe this lowers the excitation threshold of hard-to-stimulate motor units in ways that would never be possible otherwise.

William J. Kraemer, PhD, one of the world's foremost resistance training experts, had this to say about forced reps in the August 2002 edition of *Muscle & Fitness*:

> During a set, as a muscle is trained, it produces force. Motor units (muscle fibers activated by nerve impulses) are recruited, starting with the smaller ones. With each succeeding repetition, progressively larger fibers—which take more stimulation to activate—come into play. By the time you reach positive failure, theoretically all of the fibers of a muscle have been recruited.

Kraemer went on to say:

> In the past, it was thought that the use of forced reps would provide continued use of the already activated motor units. This is called "continued activation." But what we've found is that certain large muscle fibers cannot be re-activated without rest, and forced reps don't continue to activate these fibers. Instead, forced reps challenge smaller motor units, which have "recycled" during the set.

It is also believed that forced reps can condition a less inhibitory response by the Golgi tendon organ during high-intensity training. When you can no longer complete a rep by yourself and have reached the point of muscle failure, have your training partner assist you for additional repetitions, generally one to four.

This is a great way to help bring up lagging body parts, but this method must be used judiciously.

I have found that performing this no more than once per week on the final set of a given exercise is effective. Remember, this a great way to build muscle, not necessarily strength. Although strength is built from increases

20-rep Breathing Squats: This method involves doing a set of 20 repetitions in the squat with a weight you would normally do for 10 reps. Do as many as possible, and just when you feel like you will fail a rep, take 3–4 deep breaths and continue until you reach 20 reps.

Forced Reps: Lifting a weight to failure and then being assisted by a partner to do more reps, taking the bodybuilder past the normal failure barrier.

in cross-sectional muscle mass, it is developed by ingraining more efficient motor patterns. Going to failure potentially inhibits motor patterns.

What does science say?

One 2003 study published in the *International Journal of Sports Medicine* consisted of 16 weight-trained men who completed a leg workout of four sets of leg presses, two sets of squats, and two sets of leg extensions.

On the first trial, the subjects performed the set of each exercise with their 12-rep max, taking each set to momentary muscle failure. On the next trial, they went slightly heavier and had spotters assist them with forced reps until 12 reps were completed.

The results were amazing. When the subjects trained with forced reps, their growth hormone levels were three times as high as when they trained to momentary muscular failure. Growth hormone is extremely anabolic and is a potent, fat-burning hormone, so this demonstrates the effectiveness of this method for promoting fat loss and gaining muscle.

Another study showed that collegiate football players who performed three sets of 6–10 repetitions per set, taking each set to momentary muscular failure, lost less body fat over a 10-week period than collegiate football players on the same routine with the last set including forced reps.

Here is an example of a forced reps chest routine:

Bench Press	12, 8, 8, 8 (2 to 3 forced reps)
Incline Press	8, 8, 8
Chain Flyes	15, 12, 10, 10 (2–3 forced reps)
Cable Cross-Overs	12, 12, 12
Machine Press	One set to failure

This method is effective, but it causes a significant amount of peripheral and central fatigue. Proceed with caution and do not overuse it!

Negatives (Eccentric Training): Using supramaximal weights and performing only the eccentric portion of the lift.

NEGATIVES (ECCENTRIC TRAINING)

Some bodybuilders, in effort to increase intensity, use supramaximal weights and have their partners stand by as the weight is lowered.

If your bench press max is 250 pounds and you put 275 pounds on the bar and slowly lower the weight, you have performed a negative in the traditional sense. After the weight is lowered, your partner will assist you by helping you lift the weight back to arms' extension or the starting point; the weight is lowered once again, and the muscles are engaged in an all-out fight against all-mighty gravity. Some athletes can handle an excess of 160% of their one-repetition maxes on negatives.

Here is how that same lifter could implement negatives into his training:

Set 1	200 x 0
Set 2	215 x 6
Set 3	240 x 2
Set 4	275 x 3 negatives (4-second negatives)
Set 5	160 x 15

Some athletes anecdotally report doing heavy negatives in the bench prior to doing traditional barbell bench press, which allows the athletes to lift more weight and perform more reps.

If you did just handle 330 pounds on the bench press with a negative and your max is 300 pounds, it would not be unbelievable that performing reps with 260 pounds would feel lighter than usual.

Other examples of negative exercises are eccentric emphasis exercises like Smith Machine bench press, in which the athlete hypothetically bench presses 225 pounds for six reps; however, an additional 25-pound plate is placed on the bar, making the total weight 275 pounds.

Once the bar is lowered, two side spotters will quickly pull off the 25-pound plate, and the athlete will proceed to push up the 225 pounds, so he handled 275 pounds on the negative portion of the lift and 225 pounds on the positive portion, the limiting factor.

That is why this is called *negative emphasis training.* With this type of training, it is important to ensure that you have competent spotters who can quickly pull the weight off the bar. *Never attempt this with a barbell or any free-weight apparatus.*

Sticking with the bench press, another example of negative emphasis training is using a slow tempo to lower the bar and then pushing the bar to lockout forcefully. The advantage here is we can handle more on negatives, we will not tire out as easily because of higher-force production capabilities on negatives, and we still gain the benefit of an explosive positive rep. We also lengthen the time under tension—an important variable in the road to anabolism.

Another example of a negative movement for the biceps is the one-armed eccentric barbell curl. It is performed by sitting at a preacher-curl bench and grasping the center knurling of an Olympic barbell with your left hand; the back of your upper arm rests on the preacher bench in front of you with your arm supinated (palm up). The barbell should be in the finished position of a biceps curl with your palm in front of your shoulder.

Next, lower the barbell for a count of eight seconds and pause for a second at the bottom. Have a spotter assist you to the top, or you can use your right hand to assist you in curling the weight up. Repeat for reps, and then switch sides.

An example of how to use the one-armed eccentric barbell curl would be:

3–6 sets of 3–6 reps

Repetitions are kept low because just 5 reps will produce 40 seconds under painful eccentric tension!

The world of negatives is endless.

You can also push a weight to momentary muscle failure (positive failure) and have a spotter assist you on the positive portion of the rep. But because we are stronger on negatives, we can continue to do 3–4 more additional negative reps unassisted and only receive assistance on the positive portion of the lift.

An example of this type of training for the seated barbell military press would be for an athlete capable of doing 155 pounds for 8 repetitions.

Set 1	155 x 8
Set 2	155 x 8
Set 3	155 x 8
After failure do three more negatives with spotter assistance on the positive portion of the rep	

A study in the August 2009 *British Sports Medicine Journal* demonstrated that high-intensity eccentric training was more effective in promoting increases in muscle hypertrophy than was high-intensity concentric training.

Remember, we are comparing a negative to a positive, not an entire rep, a reversible muscle action. Furthermore, eccentric training has shown an increased muscle cross-sectional area when measured with magnetic resonance imaging or computerized tomography.

Although heavy eccentric training can increase muscle mass, strength adaptations are highly specific; in other words, heavy eccentric training gets you stronger in eccentric movements, not in the concentric or positive portion of the lift.

This was confirmed in that same 2009 study published in the *British Sports Medicine Journal*.

That is why it is not an effective strategy for athletes wishing to maximize strength-to-body-weight ratio. In other words, to not gain too much mass and to avoid the delayed onset of muscle soreness (DOMS), you should perform concentric-only training.

You can handle more weight on an eccentric contraction than on a concentric contraction, as we discussed earlier. Interestingly enough, far fewer motor units are activated in an eccentric contraction than in a concentric contraction. This is a recipe for muscle soreness! During negative reps, the force distributed is spread across a much smaller area of cross-sectional muscle fiber area than during a positive rep with more weight being handled.

Partial Reps: A movement performed in a specific range of motion.

DC (Doggcrap Training): Developed by bodybuilder Dante Trudel, this training method is characterized by lower-rep, higher-intensity workouts.

PARTIAL REPS

Full range of motion for full development is generally a good rule of thumb, but as the old proverb says, there is a time and a place for everything.

Partial reps are a movement performed in a specific range of motion. For the bench press, an example would be a board press; for the deadlift, a rack pull; and for a seated military press, a military press to the top of the head or presses from pins in a power rack.

Partial reps allow for an overload. In other words, you can use more weight in a partial range of motion than in a full range of motion, which will help your central nervous system adapt to heavier weights, along with providing a huge psychological boost as you climb the intensity

ladder of heavy weights. After all, how intimidating is a 300-pound bench press if you have done a 405-pound bench press off four boards?

Partials can additionally work specific range of motion, i.e., attacking sticking points.

Let's use the bench press as an example.

If you have a sticking point at the four-board height, your training weights could potentially be held back. By overloading that sticking point and eliminating it, you can now handle heavier weights on a full range of motion bench press, which means fully developed pecs. Additionally, by handling supramaximal weights, you will also strengthen connective tissue.

Remember, although partials reps are great for handling heavier weights, you should also work them at your weakest points. Many times this might mean using less weight than you could perform through a full range of motion.

That's because you're in your individual worst leverage point. This will ultimately help you blow past your sticking point and eventually handle more weight throughout the full range of motion.

Partial rep training guidelines:

- Partials are very demanding and, if overdone, can induce central and peripheral fatigue because you are lifting beyond your 1-rep max. Do not do partials more than three weeks in a row without a deload (period of lower intensity).
- Keep full range of motion movements in your program; do not use exclusively partials or include partials every single session. Ultimately, our base training is a full range of motion, and we do not want to adversely affect neurological adaptations to full range of motion movements. In other words, if you do too many partials, your full range of motion movements will feel extremely awkward.
- Use periodization training with partial movements. Do not perform partials more than 3 weeks in a row without a deload. After the deload, one more 3-week mesocycle can be completed, and then you can take time off from partials.
- Overload and work weak points.
- Make sure you are mentally and physically prepared for partial reps. You have to make sure you are tight; you are lifting more than your max!
- An athlete should be intermediate to advanced before using partial movements. The strategy of full range of motion for full development should be rode out before moving to these more advanced techniques. We would recommend at least two years of serious training experience before using partials.

Here is an example of a back routine including partial movements:

Rack Pull 18 inches (working a sticking point)	3 sets of 3 reps
Rack Pull Overload 8-inch range of motion (great for upper back development)	3 sets of 5 reps
Deadlift	3 sets of 6 reps
Rest-Pause Chin-ups with Weight	1 set (3 rest pauses)
Wide Grip Lat Pull-downs	3 sets 12 reps
Meadows Rows	3 sets of 8 reps

If you train only with partials, you will experience only partial development. Correct implementation of partials can be an integral part of building a championship physique, but they should not be the foundation of your training program.

DC TRAINING

Doggcrap Training (DC Training) is the training philosophy of Southern California bodybuilder Dante Trudel. Trudel invented this training philosophy as an alternative to more traditional high-volume approaches.

According to Trudel, he was unable to gain muscle mass taking a more traditional approach, and because of this, he developed DC Training, which Trudel believes helped take his muscle mass to the next level.

Others have echoed this claim, whereas some loudly proclaim the ineffectiveness of what they tout as "Trudel's haphazard training philosophy." There seems to be a love/hate relationship in muscle building with DC-Style Training.

The concept behind DC Training is to *train heavy*. The idea is your limit strength is your base. Stronger muscles generally equal bigger muscles. Although the correlation is not always that direct, getting stronger is a surefire way to increase neuromuscular efficiency, thereby setting the stage to increase muscle mass.

For bodybuilders, getting stronger by way of increasing neural drive will eventually lead to increased muscle mass. You'll be able to work at greater percentages of your newfound one-rep maximums.

Although countless folks who have trouble filling out a size medium compression shirt tout the mantra of not needing to lift heavy to get big, scores of scientific studies and countless stories originating from the trenches say otherwise.

Observations in the battle-hardened bodybuilding trenches of the most muscular men in the world at Metroflex Gym, like Johnnie Jackson, Branch Warren, and Ronnie Coleman, and the behemoth poundages they use, would literally squash the notion of not needing to lift heavy to get big. Lifting heavy is the foundation of DC Training and nearly every successful bodybuilding program.

The rest-pause method, discussed earlier in detail, is performed by using a heavy weight with all-out intensity and completing as many reps as possible. After failure is reached, take deep breaths while you rest 20–30 seconds and then repeat the process. Do this one more time for a total of three sets. This rest-pause method is used not just for the primary lift but also even for accessory movements.

DC Training is different from many traditional bodybuilding programs because it uses a much lower volume. The reason more people succeed with this training program over Mike Mentzer's Heavy Duty system (which will be covered shortly) is the emphasis of heavy training with compound movements.

In addition, although the volume recommendations may not be in line with scientific studies that show the superiority of high-volume programs for muscle hypertrophy, because of increased frequency of training muscle groups elicited by DC Training, weekly total volume may be closer in line with traditional recommendations.

A DC split would look something like this:

Monday	Bench Press (Chest), Upright Rows (Shoulders), Triceps Extensions (Triceps), Wide Grip Chin-ups, Bent-Over Rows
Wednesday	EZ Curl Biceps Curls (Biceps), Wrist Roller (Forearms), Calf Raises (Calves), Hack Squats (Quads)
Friday	Repeat Monday Workouts
Monday	Repeat Wednesday Workouts
Wednesday	Start cycle over; alternate exercises every 1–3 weeks

PEAK CONTRACTION TRAINING

Peak Contraction Training: Isolating a muscle by minimizing the contribution of synergist muscles engaging the overload principle of isolation.

Anybody who has been around bodybuilders for any length of time has heard them refer to doing shaping exercises or even dedicating a workout or training cycle to focus on "shaping." The reality is that you are not truly shaping, you are making your best attempt at isolating a muscle by minimizing the contribution of synergist muscles engaging the overload principle of isolation.

In other words, peak contraction training would call for a cable flye over a dumbbell flye because of the continuous tension offered. This would be done at a slow speed, purposely feeling out the tension placed on the pectorals and holding the cables together at the top, or "peak" of the movement, where tension is greatest, for 1–2 seconds, maximally contracting the chest.

The same movement would be done over any sort of pressing movement, whether at maximum speed or even at a slower speed, purposefully trying to feel the movement; the idea here is to stress the pecs, feel the movement, and have as little help as possible from assisting movements.

Because this not a natural movement pattern like a pushing/pressing movement, training this way frequently enough and with adequate volume can, to the naked eye, appear to cause a morph in muscle shape. The reality is that you have unnaturally isolated a muscle, and because of the isolation, it grows out of proportion to the synergist muscles that are no longer assisting as they would in a pressing movement. This can help you or hurt you, depending on your proportions. However, to an untrained eye, you have "shaped" your chest.

Generally, when bodybuilders talk about the mind-to-muscle connection or "feeling" a movement, they are referring to peak contraction training. Others believe the mind-to-muscle connection is a product of training as explosively as possible and using as heavy weights as possible because bodybuilders will improve neural drive to their muscles.

Who's right? Actually, both are.

To maximize the mind-muscle connection, you must not shy away from moving the heavy pig iron fast, and you are also going to have to feel some weights with peak contraction training.

Peak contraction in bodybuilding training refers to a maximum amount of resistance placed on the muscle in a contracted position. As mentioned previously, an example for the chest would be performing a cable

flye over a dumbbell flye. The reason you would perform the cable flye to elicit peak contraction of the pectorals over the dumbbell flye is that the dumbbell flye only provides great resistance in the abducted (stretch part of the flye) movement. But as you perform the adduction phase (bring your arms together) where the chest is fully contracted as the dumbbells are about to touch, the movement eases up because of the natural strength curve.

Studies have been performed on barbell movements such as the squat, bench press, and deadlift that show barbells significantly reduce over the final portion of the lift, and this is known as the negative acceleration phase.

This is the same concept applied here to the dumbbell flye. One way to circumvent this potential roadblock to hypertrophy heaven is using cables or a pec deck because of the constant tension they provide on the muscle.

The problem with using only machines is that they are designed for a specific body type, which many times will not be yours. Cables provide much more freedom of movement, so for this purpose they would be a better choice.

One technique I have currently been using with IFBB pros Johnnie Jackson and Branch Warren, along with other bodybuilding clients, with great results, is the addition of accommodated resistance techniques to traditional bodybuilding movements, such as chain flyes discussed in an earlier unit. These take a great deal of stress off the pecs and shoulders in their most vulnerable position yet allow for a true peak contraction of the pecs with the benefits free weights provide.

Yes, this is greedy, getting so much accomplished with one movement, but that is the name of the game. Another variation of the dumbbell flye for peak contraction is to put a rubber EliteFTS resistance band around your back and hold it in your hands with the dumbbell. Again, this is a great way to provide peak contraction, decrease stress in the body's most vulnerable position, and complement the strength curve of the lift.

Bands and chains can be used in pressing, squat, rowing, extending, curling—you name it. And if you are innovative, not only will they help you get stronger, which powerlifters have known for decades, but also they will enhance your physique. For more on bands and chains, see Unit 6, which is devoted to their use in bodybuilding.

Any peak contraction movement should be held in the contraction position for one to three seconds and should keep continuous tension on the muscle throughout the movement's entirety.

For example, for a leg extension movement, peak contraction entails holding the top of the movement. This is generally what well-meaning bodybuilding gurus are referring to when they pontificate about shaping exercises. Peak contraction techniques are great for single-joint exercises; after all, the sole purpose is growth of the muscle you are focused on!

Some examples of exercises that are great for peak contraction include:

Quads	Leg Extensions
Hamstrings	Leg Curls
Chest	Chain Flyes
Triceps	Single-Armed Band Push-downs
Biceps	Cable Double Biceps Curls Standing
Delts	Lateral Cable Raises
Abs	Crunches
Lats	Straight-Arm Pull-downs
Mid Back	Band-Resisted Chest-Supported T-bar Rows

WEIDER SYSTEM/PRINCIPLES

Weider System/ Principles: A collection of training philosophies and programs gathered by Joe Weider from the top athletes and coaches of the time.

The Weider principles have guided bodybuilders for more than half a century. A common criticism of the Weider System is that it is not a true system of training but in fact is more a collection of crypto-scientific muscle-building methods and guidelines based on tradition.

Although some of the criticism might hold weight, the bottom line is that most effective training methods are born in the trenches. Once anecdotal reports surface of their effectiveness, laboratory studies are then performed, generally on untrained graduate students, to confirm their effectiveness.

Look at bands and chains used in training by powerlifters for decades. Science just recently began "telling" us they work, and celebrity trainers are now using them. But those in the trenches could have told us this decades ago. Many want to classify Weider's principles as bro science, antiquated, or even as one man's attempt to monopolize the industry. However, there is no doubt that these principles have helped thousands, and Weider was truly ahead of his time.

Weider's ideas are a collection of training philosophies and programs he gathered from iron athletes of the day, the top coaches and, of course, independent writers. Joe had access to all of these people, and fortunately he shared this information with everyone else.

Joe analyzed the methods he accessed to present them in a way in which they were applicable to the lay public and, of course, the competitor. He then went on to name the principles/methods as the Weider principles. This has had a major influence on how bodybuilders have trained and do train. That was the concept of splitting your workouts to train specific body parts. The split system, double split system, and triple split system have been used since the 1950s; the split system is one of many contributions Weider made to bodybuilding science.

There are three broad categories of Weider Principles that Unit 14 breaks down in greater detail:

1. Principles to help you plan your training cycle
2. Principles to help you arrange your exercises in each workout
3. Principles to help you perform each exercise

Anyone serious about training knows that these three categories are applicable today and are the basis of good program design.

HEAVY-DUTY TRAINING

The 1978 Mr. Universe champion, the late Mike Mentzer, had some radical ideas when it came to building the body. Whether you loved him or hated him, there is no denying his ideas have influenced gym rats worldwide.

Mentzer's training system was a form of high-intensity training he named "Heavy Duty Training." A similar method had been the brainchild of Nautilus founder Arthur Jones. Mentzer did a much better job of marketing his training system, along with building a physique many considered to be the best of all time in his heyday. After all, at the 1978 Mr. Universe, he received a perfect 300 score, the first person ever to do so.

In a nutshell, Mentzer's system was based on believing virtually every bodybuilder was severely overtrained. Mentzer called for infrequent, brief, and very intense workouts. Every set was taken to absolute failure, and the goal was to always use more weight than the previous workout. Many times, just one set per body part was taken to total failure. Heavy Duty routines are generally performed for the whole body two to three times a week, and some go as infrequently as a single session every nine to ten days.

As the 1990s rolled around, Mentzer advocated an even more extreme reduction in volume. He encouraged using fewer sets and more days of rest, working out once every four to seven days and with each workout consisting of only five working sets. Mentzer believed hypertrophy was not a product of volume but rather of intensity.

Mike Mentzer was a training fundamentalist; he believed his way was the Holy Grail that led to the promised land of perfect size and symmetry and that all other methods led to eternal training damnation!

What does science say? Not much.

There have been no peer-reviewed studies on traditional higher-volume approaches versus heavy-duty training. Some of the advantages of heavy-duty training are that it saves time and that it allows full recovery and a much lower probability of overtraining.

One of the disadvantages is lack of exercise variety: With only one all-out set, it is impossible to attack the muscle from multiple angles. After all, should you choose a compound exercise or a peak contraction effort exercise? You must think long and hard if you only get one set of one exercise. It is much more difficult to achieve a pump, and the internal satisfaction of completing a workout is much less if all you do is perform five total sets.

A vast majority of champions, from natural, local level, to juiced-up professionals, have built their physiques with a much more high-volume approach than the heavy-duty system. An abundance of studies shows the advantage of high-volume training for adding muscle. Unfortunately, none of them has ever been directly compared to the heavy-duty training system.

Anecdotally, this system would not appear to be superior by any means. You might be thinking, well I have a friend who put on eight pounds of muscle in a month using this workout system—but odds are he changed his diet or added in some quality muscle-building supplements and maybe even some not-so-legal muscle-building supplements.

Another explanation may be that your friend was severely overtrained, and this short stint of heavy-duty training essentially served as a deload (a reduction in volume). Because of this, super compensation took place, and he grew. Odds are, this rate of muscle hypertrophy dissipated rather quickly.

Could heavy-duty training be cycled into a bodybuilder's arsenal from time to time? Certainly. Should the bodybuilder abandon all other forms of training and become a devout heavy-duty disciple? Absolutely not!

Heavy Duty Training: Developed by Mike Mentzer, this system calls for infrequent, brief, and very intense workouts.

Peripheral Heart Action Training: This training method focuses on keeping blood circulating throughout the body for the entire workout. This is done by attacking the smaller muscles around the heart first and then moving outward.

PERIPHERAL HEART ACTION TRAINING

This system of bodybuilding circuit training was popularized to the masses by Bob Gajda, a Mr. Universe and Mr. America winner in the 1960s, but it was actually the brainchild of Chuck Coker.

The idea is to keep circulating blood through the body throughout the entire workout. This is achieved by attacking the smaller muscles around the heart first and then moving outward. This system is vigorous and requires continued intense exercise for a prolonged period with no rest. For these reasons, the poorly conditioned bodybuilder and the faint of heart will not do well with this training system.

The idea with peripheral heart action (PHA) training is to use primarily compound movements for efficiency. The system is composed of four sequences of exercises, and each sequence is designed to encompass every major body segment. The goal is to "shunt" blood up and down the body. This is extremely taxing on the cardiovascular system, for which the obvious benefits are a reduction in body fat and, of course, improved metabolic rate.

Because each sequential body part covered in each sequence is getting adequate rest between each circuit, strength will be conserved, allowing close to maximal strength to be exhibited on the sequential bout.

Even though your heart will likely beat at more than 150 beats per minute throughout the entire workout, this does not give a license to reduce the weights used.

Here is an example of PHA Training designed by Fred Hatfield, Ph.D., aka "Dr. Squat," legendary trainer, former world-record holding powerlifter, and ISSA cofounder. Perform each movement for six to ten reps, using as much weight as possible without sacrificing form.

Sequence 1	Partial Press Crunches Squats Triceps Extensions
Sequence 2	Pull-downs Back Raises Leg Curls Biceps Curls
Sequence 3	Bench Press Side Bends Left Leg Extensions Dips
Sequence 4	Bent Rows Side Bends Right Toe Raise Shrugs

Dr. Hatfield provided the following guidelines:

- Perform the exercises in sequence 1 for the required number of reps sequentially and do not stop!
- Repeat the sequence two to three more times and then move on to sequence 2, performing it the same way you performed sequence 1.
- Do the same thing for sequences 3 and 4. Do not rest during a sequence and do not rest between sequences unless absolutely necessary. After all, long breaks defeat the purpose.
- Maintain your heart rate at 80% of your heart rate max; wear a monitor so you can adjust the pace accordingly.
- If you are in shape, you will not need to trade heavy weight for a slower pace or longer rest.

CIRCUIT TRAINING

Circuit training is similar to PHA training, only it's a strategy more suitable for the beginner level trainee. The objective in PHA training is to keep the heart rate at 80% of your maximum. With circuit training, your goal is to complete the prescribed exercises within a time limit.

Circuit training is supposed to increase your metabolic rate and raise your heart rate, so the emphasis should be on larger muscle groups. You do not want to give up the strength aspect, so it is recommended to perform circuits with an emphasis on opposing muscle groups, preferably with an emphasis on compound movements.

An example would be that the Romanian deadlift/close grip bench press/chin-up/front squat circuit is superior to a leg curl/triceps pushdown/biceps curl/leg extension superset.

The objective is to move through the circuit fast and nonstop; you want to beat your target time!

Time Under Tension (TUT) Training: Focusing on how long a set or rep takes rather than just reps.

TIME UNDER TENSION (TUT) TRAINING

In layman's terms, time under tension (TUT) means how long it takes to complete a set. Traditionally, hypertrophy sets have been advocated simply by performing six to fifteen repetitions in a given set. Though this is great for simplicity, it doesn't tell the whole story of the adaptations truly taking place.

Just think, if you bench press 50% of your max for 10 repetitions in 8 seconds, it is not the same as using 80% of your one-rep max for 8 repetitions, with the sets taking 40 seconds to complete. Just by looking at the variables presented, a different speed of contraction took place, more weight was used and, of course, the muscle was under tension much longer.

Muscular adaptations are much more complicated than a simple rep scheme. One measurable variable we have that can help induce a hypertrophic response is time under tension (TUT).

A typical set of 10 repetitions with a challenging weight will take approximately 20 seconds. What if that set took twice as long? Well, longer strain equals more muscle breakdown, which in turn will lead to more muscle growth when used correctly. How long your muscle is under tension is extremely important to how much it will grow!

Studies generally show the most effective time under tension for maximal hypertrophy is 30–50 seconds per set. The total length of time is important; however, avoid spending maximal time in the portion of the lift that is the easiest.

If you are leg pressing, don't spend 5 seconds at lockout between reps, because this compromises the amount of tension on your muscles. If you feel like you are resting, you are! In turn, you are compromising your results. Because you can handle much heavier lifts on the eccentric (negative) portion of a lift, instead of sitting at lockout cheating the clock and yourself, draw out the eccentric—make it take 3–5 seconds.

With time under tension, it is important to use the heaviest weights possible while maintaining good form. However, you are better off doing a partial movement with maximum intensity once you have reached failure than to just hold a weight in a locked-out position and resting to conserve energy.

Many advocates of time under tension training advocate a prescribed tempo such a 4-second negative, 1-second isometric hold at the bottom, 2 seconds on the positive, and a 1-second hold at the top of the movement. They believe perfect form must be maintained the whole time and, if it deviates, one must stop and reduce the amount of weight being used. The key, after all, is to use full range of motion for full development, correct? In most cases, absolutely, and that's the way these sets need to start.

I believe a more effective approach is to go for maximum reps in a prescribed amount of time using a moderate pace, doing as many as possible within that time frame and, if momentary muscular failure is reached, cheat—do an isometric hold or partial movement. Just keep that maximum tension going the whole time and do not rest by dropping weights or rest-pausing. This training is intense, and I recommend starting each set with a weight you can complete for 10–12 reps and then taking a rest interval that is three times as long as the previous set was. For example, 30 seconds under tension would call for a 90-second rest interval. Each set, because generally failure will be reached, calls for a one-third reduction from the previous set, so each exercise should be performed for no more than three sets.

Here is a three-week wave of time under tension training; a deload, or period of reduced intensity, is recommended after three weeks of this intense training.

Week 1 (30 seconds time under tension, 90-second rest interval)	
Day 1—Chest & Triceps	
Incline Dumbbell Bench Press	Set 1–90 lbs, Set 2–60 lbs, Set 3–40 lbs
Cable Flyes	Set 1–60 lbs, Set 2 40 lbs, Set 3–30 lbs (rounded)
Close Grip 3 Board Press	Set 1–210 lbs, Set 2–140 lbs, Set 3–100 lbs
Triceps Pushdowns	Set 1–75 lbs, Set 2–50 lbs, Set 3–35 lbs
Day 2—Back & Biceps	
Cambered Barbell Rows	240 lbs, 160 lbs, 110 lbs
Wide-Grip Lat Pull-downs	180 lbs, 120 lbs, 80 lbs
Zottman Curls	30 lbs, 20 lbs, 15 lbs
Scott Curls	60 lbs, 40 lbs, 25 lbs
Day 3—Legs & Shoulders	
Hack Squats	300 lbs, 200 lbs, 140 lbs
Stiff -Leg Deadlifts	240 lbs, 160 lbs, 100 lbs
Dumbbell Military Presses	60 lbs, 40 lbs, 25 lbs
Lateral Raises	30 lbs, 20 lbs, 15 lbs

Here is the way this program would progress over the next two weeks. During Week 2, the same weights would be used, but the time under tension would increase to 40 seconds. This would also add another 30 seconds to the rest interval so that it's now 120 seconds.

For Week 3, the same weights would be used, but the time under tension would increase to 50 seconds. And because of this additional 10 seconds under tension, the rest interval would increase to 2.5 minutes. This is a great way to add mass! This is intense, and you must reduce intensity after this tough mesocycle.

Tempo Training: Involves performing reps at a prescribed cadence.

Powerbuilding: A hybrid of powerlifting and bodybuilding.

TEMPO TRAINING

We just learned about the importance of time under tension and the potential hypertrophic response this training variable can induce. The legendary Charles Poliquin popularized tempo training.

In essence, your goal is not only to perform a specific set in a predetermined amount, but also to perform the reps at a prescribed cadence. Different speeds of contraction cause different adaptations to resistance training: A shot-putter needs to train fast contractions; you, the bodybuilder, need to train a wide array of speeds.

Four numbers make a tempo; let's look at a 4-1-2-1, a common prescription for hypertrophy.

The first number 4 is the negative (eccentric phase). Let's say you are bench pressing; this means take 4 seconds to lower the weight to your chest.

The second number is a 1, meaning a 1-second pause at the bottom of the lift between the negative and positive portion rather than an isometric hold of the weight on your chest for 1 second.

The third number is the amount of time it will take to perform the positive or concentric portion of the lift, in this case, 2 seconds.

The last number, 1, is the isometric hold of 1 second at the top of the movement before beginning the negative portion of the lift. One complete rep will take 8 seconds, so 6 repetitions will produce a total of 48 seconds under tension. This makes prescribing repetitions much easier if you are seeking a certain amount of time under tension.

Some swear to the tempo prescription as the Holy Grail to muscle building and strength gain supremacy, whereas others view it as an unnecessary variable that at best detracts from maximum intensity.

Then who's right? Both.

There is a time and a place for the tension variable in training. Could it be valuable for a peak contraction set of cable flyes? Yes!

What about for a max triple in the deadlift? No, it will just detract from intensity. As bodybuilders, we need to take a holistic training approach; tempo is one more variable that can have a place in your training.

POWERBUILDING

Brian Dobson and I wrote about this in the groundbreaking book *Metroflex Gym Powerbuilding Basics*. In it, we wrote, "In the past, the founding fathers of bodybuilding were required to perform feats of strength in addition to their posing routines. This meant men with great physiques also possessed great strength and power, and those who possessed great strength and power did not look like total 'slobs.'"

Even if bodybuilding is your goal, your limit strength—or how much force you can exert in one all-out effort—is the base of both athletics and physique building.

It is important for strength athletes to include the small exercises that assist in the core lifts. Remember that Branch Warren, Johnnie Jackson, and Ronnie Coleman all started out as powerlifters. That foundation of limit strength set the stage for their superhuman physiques.

Powerbuilding is a hybrid of powerlifting and bodybuilding. Successful powerlifters are part bodybuilder, and successful bodybuilders build their base with powerlifting.

Studies confirm that exercise sequence is extremely important for the desired adaptations of training to occur. In other words, the most important exercise needs to be the first exercise in your routine.

The difference between powerbuilding and post-exhaustion training is that powerbuilding emphasizes the big three, the competitive powerlifts: squat, bench press, and deadlift—the cornerstone of your training.

Essentially, the workout starts off with a heavy core lift and the assistance work, and more traditional bodybuilding techniques follow suit; thus, a back day begins with the deadlift, a chest day with the bench press, and a leg day with the king—squats!

Powerbuilding is traditionally much higher volume than many powerlifters use in preparation for meets. Many use this form of training in the off-season, and some even do it leading up to a powerlifting contest.

Three of the most famous powerlifters who were avid powerbuilders are the legendary Ed Coan, Dave Pasanella, and the immortal Bill Kazmaier.

Some bodybuilders train this way right up to

contest time, whereas others do it in the off-season. After all, how can we forget Ronnie Coleman's dead-lifting 800 pounds, three weeks out from the Olympia?

If a bodybuilder is big and freaky but never trains with heavy core lifts, at some point—whether it be post-exhaustion, reverse pyramid, or powerbuild-ing—odds are he is primarily a product of great drugs and/or great genetics. Dr. Fred Hatfield once said, "When all else fails, don't get cute, pile on the pig iron." That sums up powerbuilding.

Here is a sample powerbuilding routine:

Day 1—Back
Deadlift: 3, 6, 6, 6, 6
Cambered Bar Bent Over Rows: 10, 8, 6
Straight Arm Pull-down/Wide Grip Chin-up superset: 3 sets
Hyper Deadlifts: 8, 8, 8
Seated Rows, Slow, Continuous Tension Training: 2 minutes
Abs/Calves

Day 2—Chest
Bench Press: 4, 6, 8, 10
Neutral Grip Incline Press: 12, 12, 12
Weighted Dips: 8, 8, max reps 1 minute (bodyweight)
Chain Flyes: max reps x 3 sets
Pec Deck: 1 set (3 rest pauses)

Day 3 Off

Day 4—Arms
Decline Close Grip Bench against Chains: 6, 6, 6
Floor Barbell Paused Triceps Extension: 12, 10, 8
Triceps Kickback/Diamond Push-ups superset: 3 sets
Chin-ups/Biceps Curl: 5-second eccentric superset x 3
Zottman Curls: 12, 12, 12, 12
Cable Preacher Curls: 12, 12, 12

Day 5—Legs
Squats: 6, 6, 6, 10
Dead Stop Leg Press: 15, 15, 15
Leg Curls: 6, 6, 6, 12
Glute/Ham Raises: 8, 8, 8
Leg Extension: 15, 15, 15
Dumbbell Lunges: 12, 12, 12
Abs/Calves

Day 6—Shoulders
Overhead Press: 5, 5, 5, 12
Lateral Raises Seated: 15, 15, 15, Rest Pause
Face Pulls: 12, 12, 12
Reverse Flye: 12, 12, 12
Abs

Day 7 Off

Compensatory Acceleration Training: Moving submaximal weights as fast as possible.

Muscle Priority Training: In this type of training, you simply work your weakness first, before you are too fatigued.

Cheating Exercises: This entails swinging a weight past a sticking point; on a front raise, it might be a slight hip bump out of the bottom; on a bent-over row, it might be a slight vertical pull on the way up; it may be a "kip" to finish off your last rep on pull-up.

COMPENSATORY ACCELERATION TRAINING (CAT)

Compensatory acceleration training (CAT), popularized by Dr. Fred Hatfield, simply means lifting sub-maximal weights with maximal force.

CAT training provides the bodybuilder with great neural adaptations, a true mind-muscle connection. Because CAT training is performed in basic core lifts, the learning curve is virtually nonexistent, especially

compared with Olympic lifts designed to improve speed strength.

If we look at the force velocity curve, the speed of muscle contraction is proportional to the intensity of the load. Large forces cannot be produced at extremely high speeds.

Conversely, maximum acceleration cannot be achieved with near-maximum weights; however, neuromuscular efficiency can be enhanced without the stress imposed on the central nervous system by lifting maximal weights, allowing similar neural adaptations to occur.

In the long run, you will become stronger including CAT in your program. Higher limit strength means heavier sets of 10–12 reps on core movements and heavier weights used on single-joint movements. Bodybuilders must train slow and fast, unlike many other athletes.

MUSCLE PRIORITY TRAINING

Even if you are new to bodybuilding, this term is pretty self-explanatory. Think of the studies we examined earlier; the conclusion was to work whatever is most important in your workout first. Generally, in this context, it is working your weakness first; after all, once all weakness is eliminated, you will proudly sport an armor-clad, prize-winning physique.

Your weakness needs to be priority one. That is, of course, within reason. If you are training your arms and your biceps are stronger than your triceps, pumping up your biceps so much that you cannot get a good range of motion on triceps extension exercises will do you no good.

If less-than-adequate-sized triceps are your arch nemesis, you are going to start with an exercise like heavy, close grip, 3 board presses with bands or chains. A compound movement builds the most size; this would not be done after 100 reps of cable push-downs.

Know your priorities: then organize your training around them based on what you hope to accomplish.

CHEATING EXERCISES

Brian Dobson, world famous Metroflex Gym owner and trainer, said this in the book he coauthored, *Metroflex Gym Powerbuilding Basics:*

Whenever I train a person who is not into bodybuilding or powerbuilding, they act as if it is wrong to heave up heavy iron on the cheat curl, usually citing how their last trainer said to stay perfectly straight and not to lean back. These trainees usually have arms that are less than 14 inches, and the trainers' arms are usually less than 15 inches! Trust me on this: Heavy cheat curls build big, strong arms.

This makes sense. After all, if you need advice for how to fix your car engine, are you going to look for it at a bank? Certainly not. If you are hell-bent on getting big and muscular, you are going to look at what such greats as Arnold, Ronnie Coleman, Bill Kazmaier, Johnnie Jackson, Branch Warren, and Ted Arcidi have done.

The bottom line is this: Big, muscular, strong people have demonstrated the effectiveness of the cheat curl repeatedly. While I am citing the curl as an example, cheating is an advanced bodybuilding principle that, when used correctly, can open up the gates to an anabolic paradise.

What does cheating mean exactly?

Generally, it means swinging a weight past a sticking point; on a front raise, it might be a slight hip bump out of the bottom; on a bent-over row, it might be a slight vertical pull on the way up. It may be a "kip" to finish off your last rep on pull-up.

The philosophy is similar to what is used for a drop set: On a drop set, you reduce resistance to continue the set; on a cheating movement, you get outside swing help to complete the movement. Cheating does not require a partner's assistance.

When you perform a cheating movement, using the curl again as an example, while you do use some swing to complete the movement, you finish the movement with the target muscle (the biceps), which have effectively been overloaded. Swinging the weight all the way up is counterproductive and serves no real purpose in bodybuilding training. Although some bodybuilders have used this technique, they always started the workout with lighter, stricter reps.

It is also critical to perform the negative portion of the lift under control because, not only do you have the capabilities to handle up to 160% of what you can on a positive, but also you would rob yourself of the hypertrophy that can be gained on a controlled eccentric. A controlled eccentric takes a couple of seconds to lower the weight. An uncontrolled drop not only will kiss maximal hypertrophy good-bye but also will open the door to a life of arthritis and getting to know your local orthopedic surgeon on a very personal level.

Cheating is an advanced high-intensity technique that should only be used by experienced lifters. Furthermore, it should under no condition be used every workout. Use it infrequently on body parts you are trying to bring up—you know, those stubborn ones that just can't figure out they are supposed to grow.

Here are some cheat exercises that advanced bodybuilders have used effectively:

- Shoulders: Front Raises
- Arms: Cheat Curls
- Back: Bent-Over Rows

This advanced training principle can help you cheat your way to the top with proper implementation!

Periodization Training: Refers to how one's training is broken down into discrete time periods called macrocycles, mesocycles, and microcycles. Essentially, we look at long-term and short-term planning by systematically cycling methodology, volume, and intensity toward one's goals.

PERIODIZATION TRAINING

As discussed in Unit 9, periodization training is not the latest 12-week program you saw on an infomercial at 3 a.m. or the glossy *Flex Magazine* foldout you read. Periodization is a logical, sequential organization of purposeful training toward one's goals.

Periodization refers to how one's training is broken down into discrete time periods called macrocycles, mesocycles, and microcycles. Essentially, we look at long-term as well as short-term planning via systematically cycling methodology, volume, and intensity toward one's goals.

Some might ask, "Why not just train all fitness variables maximally all-out year-round—trying to maximize muscular size, symmetry, and limit strength—bring up lagging body parts, minimize body fat, and be in peak aerobic condition?"

Though this may be the training objective of the cross-fitter or recreational gym rat, it is not possible to accomplish these objectives simultaneously. Just take a look at the poor misguided souls who continue to spin their wheels and fail to progress in meeting the above objectives.

For you, the competitive bodybuilder or serious iron athlete who has long-term goals of balancing size and symmetry and minimizing body fat, there is a better way—it's called periodization!

Training with purpose and managing objectives is what you must understand. For some bodybuilders, working on a limit strength base may be a major off-season priority; for others, it might be to add overall mass. Yet others may have a lagging body part that needs extreme focus.

Then there is contest prep and different phases that apply to different bodybuilders' nutritional strategies, cardio training, and posing routines. The bottom line is that you can't do it all at once if you want to be the best!

A FEW LAST WORDS

To maximize muscular development, it is important you have knowledge of various bodybuilding methods. If you decide to use a new method, it is important to know why. If you avoid a certain method, you should have a reason for doing so. Take this knowledge and build with it.

TOPICS COVERED IN THIS UNIT

- Essential Nutrients
- Macronutrients
  - Carbohydrates
  - Protein
  - Fats
  - Vitamins and Minerals
  - Hydration
- Basic Nutritional Guidelines for the Bodybuilder
- Nutritional Guidelines
- Nutritional Guidelines for Maximizing Your Physique and Performance
- Intra- and Post-Workout Needs
- A Few Last Words

UNIT 12

NUTRITION

Hard training, high-performance athletes require high-performance fuel! Bodybuilders train as hard as any athlete does, but there's a difference: Not only do bodybuilders have to perform in the gym, but also they must look great doing it. If you aren't maintaining a proper diet, it is impossible to perform at the highest level in the gym or look your best on stage. The old cliché "You are what you eat," is based on reality.

Nutrition is important in any sport, and every sport has champions who defy the odds and break every dietary guideline, with one exception: bodybuilding. You cannot expect to be a champion unless you eat like one. As you read through this unit, remember that this is not a nutrition course. The ISSA does, though, offer a Specialist in Fitness Nutrition course that is dedicated to outlining both basic and advanced dietary strategies that promote optimal health, body composition, and performance for people of all fitness levels.

ESSENTIAL NUTRIENTS

Essential nutrients are those nutrients that the body does not produce at all or makes in insufficient quantities. As such, we must obtain these nutrients through our diet. The six types of essential nutrients needed in the daily diet include fats, carbohydrates, proteins, vitamins, minerals, and water.

MACRONUTRIENTS

There are three "macronutrients." As you can probably deduce from the name, macronutrients are those nutrients that the body needs in large amounts. These three macronutrients are carbohydrates, protein, and fat.

CARBOHYDRATES

Carbohydrates are not just the body's preferred source of energy but also the most easily digestible macronutrient. There are two kinds of carbohydrates: the simple ones (sugars) and the complex ones, which include starches and fibers.

The body controls blood sugar levels by absorbing carbohydrates from foods and by breaking down stored carbohydrates. The hormones insulin, glucagon, and epinephrine control blood sugar.

Most of you reading this are likely familiar with the glycemic index (GI). The GI is the blood glucose response for two hours after food is eaten, compared with a two-hour response of the equivalent amount of glucose

Essential Nutrients: Those that the body does not produce at all or it makes in insufficient quantities. Because of this, we must obtain these nutrients through our diet.

Macronutrients: Those nutrients that the body needs in large amounts.

Carbohydrates: The body's preferred energy source. A carbohydrate is composed of hydrogen and oxygen. There are two kinds of carbohydrates: the simple ones (sugars) and the complex ones, which include starches and fibers.

Fiber: Fiber is not an energy source; in fact, the human gut cannot digest it. However, fiber has protective qualities. It helps promote efficient intestinal function such as regulation and absorption of sugars into the bloodstream. Fiber also helps soften the stool and promotes normal defecation patterns.

Protein: A substance found in foods (such as meat, milk, eggs, and beans) that is an important part of the human diet and muscle building.

Fats: You must have fat in your diet; your body uses fatty acids to do things such as building cell membranes and performing core functions in the brain, eyes, and lungs. Some other functions of fats include functioning as a fuel source during exercise, providing insulation, aiding in absorbing fat-soluble vitamins, supplying essential fatty acids, providing protective padding for body structures, and protecting your nerves.

eaten. It is important to eat primarily low-glycemic carbohydrates. The lower the GI, the less rapid the glucose response will be. When you eat foods with a lower GI, your body will maintain more stable blood glucose levels. High-glycemic carbohydrates that are easily converted to adipose tissue should be avoided in most cases, the exception being immediately post workout.

Potatoes, brown rice, oatmeal, cream of rice, Ezekiel bread, yams, and quinoa are quality carbohydrates recommended for the bodybuilder. A majority of your carbohydrates should come from complex sources. Your mother always used to tell you to eat your vegetables, and she was right!

Vegetables are fibrous carbohydrates that help aid in digestion of food and the defecation process and additionally serve as an abundant source of nutrients. Carbohydrates, under normal circumstances, should make up 30%–50% of your diet, but carb cycles and contest prep would not be classified as "normal" circumstances.

The 1980s and '90s were nutritionally dominated by the low-fat zealots, but in the last decade, the low-carbohydrate zealots have made their presence known.

All sorts of exotic low- and no-carb weight-loss fad diets have been advocated. Before you jump on the anti-carbohydrate bandwagon, remember this: Carbohydrates are your body's first choice of fuel for physical activity. Additionally, carbohydrates fuel the brain and central nervous system.

Fiber

Most people, regardless of goals, do not eat enough fiber. Fiber is found in plants, fruits, leaves, grains, nuts, seeds, and legumes. Fruits and vegetables are the best choices for sources of fiber. Many functional benefits result from eating a high-fiber diet, and numerous studies confirm that high-fiber diets reduce the rate of cardiovascular disease, colon cancer, and diabetes.

Fiber is not an energy source; in fact, the human gut cannot digest it. However, it has protective qualities. It helps promote efficient intestinal function such as regulation and absorption of sugars into the bloodstream. In addition, fiber helps soften the stool and promotes normal defecation patterns. Many health agencies recommend 20–30 grams of fiber a day. This may be sufficient for a person on a low-calorie diet, but for someone attempting to add muscle bulk on a high-calorie diet, 50–80 grams of fiber might be needed.

PROTEIN

Proteins are the body's most important structural material, composing much of muscle, bone, enzymes, some hormones, and cell membranes. Proteins are constructed of amino acids. Nine of the twenty amino acids found in food are considered essential in the diet because the body cannot make them. These essential amino acids include histidine, isoleucine, leucine, lysine, methionine, phenylalanine, threonine, tryptohan, and valine.

The following foods are quality protein choices for the bodybuilder's diet: eggs, chicken breast, turkey breast, fish, and lean red meats. If finances permit you to do so, I would highly suggest buying organic poultry, grass-fed meat, and cage-free eggs. Fish should be wild caught, not farm raised.

Quality protein supplements are convenient, work well, and often are more economically feasible than buying the aforementioned protein sources is. Whey protein powder, casein protein powder, and egg protein powder are conveniently available. Generally, multi-blends are preferable.

Avoid soy protein powder because, aside from not being a complete animal-based source of protein, numerous studies have shown that it

lowers testosterone levels. As a bodybuilder, you definitely do not want this.

For further reading on this subject, visit www.joshstrength.com and read my article, "The Effect of Whey and Soy Protein Supplementation on Lean Body Mass (LBM) of Resistance Trained Young Men."

Vegetarian and vegan athletes can have difficulty consuming adequate protein. Because they are not eating complete animal sources of protein, it has been suggested in many nutritional journals that these athletes need to consume 10% more protein than their animal product-eating counterparts do.

Generally, with intense bodybuilding training, 1 gram of protein per pound of bodyweight is the minimum recommended. For vegans or vegetarians, the minimum is 1.1 grams of protein.

Some crucial points to remember about protein:

- Protein is essential for growth and recovery.
- Branch-chained amino acids (leucine, isoleucine, and valine) are required to keep muscle breakdown to a minimum.
- High-quality protein should be consumed, such as grass-fed beef, fish, lean poultry, and cage-free natural eggs with 350 mg of omega-3 fats minimally per egg. Unless you are on highly restricted calories, eat the yolk.
- Consume protein with every meal.
- High-quality protein supplements can be used, but remember the real thing is always better than a synthetic product. The keyword is supplement, not substitute. Consider natural foods as a supplementation option whenever they are available.
- Not all protein is created equal! Protein in whole dairy products and fatty meats is difficult to digest, if your body even digests it at all. Stick to lean, natural sources of protein.

FATS

Fats are the most energy rich food source, and they are essential for bodily functions. Your body uses fatty acids to do things such as build cell membranes and perform vital functions in the brain, eyes, and lungs. Other functions of fats include working as a fuel source during exercise, providing insulation, aiding in absorbing fat-soluble vitamins, supplying essential fatty acids, providing protective padding for body structures, and protecting nerves. Additionally, fat is essential in keeping your lungs and eyes working properly and also helps your immune system and metabolism function properly. Due to the importance of fat's role in the body, the general recommendation for consumption of fats is between 15% and 30% of your daily diet.

Remember, not all fats are created equal. You'll likely remember from your ISSA Certified Fitness Trainer course that fatty acids are classified according to their structure as saturated, monounsaturated, or polyunsaturated. Fats are called "saturated" if they contain high amounts of saturated fatty acids. Foods highly saturated in fat include hamburger, lunchmeat, cheese, butter, and whole milk.

A dangerous form of fat is trans-fat (trans fatty acids), primarily contained in solid or semi-solid margarines and commercial cooking oils used in processed foods. Liquid oils go through a process called hydrogenation that involves adding hydrogen atoms to the fat. This makes the oil solid and helps preserve the product. The trans-fat made through this process increases cholesterol levels and has been linked to heart disease and some forms of cancer.

For the most part, your fat consumption should be from unsaturated sources such as olive oil, flax oil, salmon, and grass-fed organic meats. Avoid fried foods, fast food, processed

lunchmeats, extremely fatty meats/poultry, margarine, shortening, and many salad dressings, even in the offseason.

"Choosing the right types of dietary fats to consume is one of the most important factors in reducing the risk of developing heart disease," said Alice Lichenstein, DSC, a renowned researcher from Tufts University in Boston.

For a long time, especially in the 1980s and '90s, low-fat diets were the fad. This did not yield better physiques or better health.

Actually, the opposite happened, as the obesity level skyrocketed.

The rate of obesity in America has doubled in the last 20 years. In the 1960s, fat made up around 45% of the average American's diets—and less than 15% of the US population was obese.

Average Americans now get less than one-third of all their calories from fat, and approximately 34% of Americans are obese. Therefore, there is more to the obesity epidemic than an increase in dietary fats. Fat has gotten a bad rap because of its caloric density. One gram of fat yields 9 calories, compared with just 4 calories per gram in carbohydrates and protein. If you are unsure of the fat content of the food you purchase, read the nutritional label on the food. It should say the number of fat grams, the type of fat (i.e., monounsaturated, polyunsaturated, saturated), and the number of calories from fat per serving.

Numerous studies have attempted to show a link between heart disease and saturated fat intake; the majority of these studies have failed to show any sort of correlation whatsoever. The studies that have shown such a correlation usually contain some flaw. An example of flawed studies is the ones that lump together artificial trans-fat consumption with saturated fat consumption, which the body absorbs completely differently. It is still not recommended to consume excessive amounts of saturated fats (and I agree with this recommendation), but to be fair and impartial, the jury is still out on saturated fat.

VITAMINS AND MINERALS

Vitamins

Vitamins: Any of various relatively complex organic substances found in plant and animal tissue and required in small quantities for controlling metabolic processes

Vitamins are any of various relatively complex organic substances found in plant and animal tissue and required in small quantities for controlling metabolic processes. Everyone needs vitamins, and active people need more vitamins than sedentary people do.

If you want to successfully achieve peak performance capabilities, you need to provide your body with everything it needs. Vitamins are undoubtedly essential to physical performance. Each of the vitamins has a specific responsibility in your body. Below are the vitamins essential to successful physical performance.

Vitamin A helps maintain your skin and mucous membranes and contributes to the function of night vision. Excess vitamin A intake can be toxic, as this vitamin is fat -soluble. Vitamin A can be found in carrots and yellow vegetables.

Vitamin B1 (thiamin) is responsible for carbohydrate metabolism, along with the function of your nervous system. More than 1,000 milligrams of B1 might cause increased urination and possible dehydration. Because this vitamin is water-soluble, daily replacement is necessary. Whole grains are the best source of B1.

Vitamin B2 (riboflavin) is an active agent in the metabolism of energy and cell maintenance. It is also an essential ingredient in the repair of all cells following injury. Milk and eggs are excellent sources of vitamin B2.

Vitamin B3 (niacin) has numerous responsibilities in various bodily functions and is present in every cell in your body. This vitamin can cause hot flashes, but you can build a tolerance to this vitamin and find it helpful in the reduction of high cholesterol. Peanuts and poultry are fine sources of B3.

Vitamin B5 (pantothenic acid) is essential in the formation of the chemical acetylcholine, which is involved in nerve transmission and memory and is crucial in the metabolism of energy. Poultry, fish, and whole grains provide you with ample levels of this vitamin.

Vitamin B6 (pyridoxine) is involved in the metabolism of sugar, fat, and protein. A limit of 300 mg per day is adequate for any athlete. It can be found in foods such as wheat germ, fish, and walnuts.

Vitamin B12 (cobalamin) refers to substances containing the mineral cobalt, which is important in the metabolism of protein and fat and aids in red blood cell production. Sources include liver, oysters, and clams.

Vitamin B15 (pangamate or pangamic acid) is a coenzyme involved in respiration, protein synthesis, and regulation of steroid hormones. Its principal effect is to increase blood and oxygen supplies to tissue. Deficiency states produce no apparent negative effects, leading some conservative nutritionists to conclude that it is not a "true" vitamin. B15 is found principally in brewer's yeast, organ meats, and whole grains.

Folic acid (folacin) is a helper substance of the B complex group, especially in red blood cell formation. Five milligrams a day is recommended for athletes.

Biotin helps metabolize carbohydrates and fats. Best sources are brown rice and soybeans.

Choline is an agent helpful in the use of the B complex vitamins. It is crucial in normal brain function (notably memory) and acts as a factor in metabolizing fat and cholesterol. The best food sources are eggs and lecithin.

Inositol is helpful in the use of B complex vitamins. It acts with choline in metabolizing fat and cholesterol. In addition, it plays an important role in the transmission of nerve impulses. Lecithin and wheat germ are good sources of inositol.

Para-aminobenzoic Acid (PABA) is essential for normal skin and hair growth. Sources include whole grains and wheat germ. It is (at least partially) synthesized in the intestinal flora, a fact that has led conservative nutritionists to deny a need for it in the diet.

Vitamin C (ascorbic acid) is a water-soluble vitamin similar to the B complex vitamins. It is involved in various bodily functions and may produce diarrhea and mild diuretic effects in some people. Citrus fruits provide a good source of C.

Bioflavonoids are chemicals that contribute to the strength of your capillaries and help to protect vitamin C stores in your body. These vitamins can be found in fresh raw vegetables and fruits.

Vitamin D (calciferol) is a fat-soluble vitamin that regulates calcium and phosphate metabolism in your body. This vitamin is actually formed on your skin via ultraviolet rays from light, when they react with cholesterol in your skin. Sunlight serves as the best source of vitamin D, but this vitamin is also added to milk.

Vitamin E (d-alpha-tocopherol succinate) is another fat-soluble vitamin that has numerous responsibilities in your body. Recent research clearly shows the importance of vitamin E in fighting the ravages of free radical damage inside your body. If ever there were an anti-aging elixir, this is it. Food sources available are wheat germ, green leafy vegetables, whole grains, and vegetable oils.

Vitamin K ("K" stands for "Koagulation"): This vitamin contributes to proper blood clotting. It is synthesized in the intestinal flora. Because it is fat-soluble, it has the potential for toxicity if taken in large doses. There is no established RDA.

Minerals

Minerals: A chemical substance (such as iron or zinc) that occurs naturally in certain foods and that is important for good health and performance.

Through vast research, it is now known that minerals play a significant role in various bodily functions essential to physical movement. And a deficiency in any mineral can be disastrous to peak performance.

Minerals are found in plants, animal foods, and drinking water. Many times, the quantities of minerals found in these sources are too small. Because the stresses associated with sports activities promote the loss of various minerals, it becomes important to increase your mineral intake.

Bodybuilders vary in the amounts of extra minerals needed. Much depends on your age, gender, genetics, medical history, and training. In practical terms, estimates provide guidelines, not concrete recommendations.

Calcium is the most abundant mineral in your body. It helps make up your teeth and bones and is needed for muscle contractions. Only about 10% of the calcium in dairy products is absorbed in your body.

No wonder many people are deficient in this mineral. An athlete deficient in calcium may experience stress fractures. Good sources of calcium are dairy products and calcium carbonate supplements.

Magnesium is another mineral essential to muscle contraction, notably in the relaxation phase. A lack of magnesium produces fatigue, spasms, muscle twitching, and muscle weakness. Foods that provide quality magnesium are soybeans, leafy vegetables, brown rice, whole wheat, apples, seeds, and nuts.

Phosphorus is the second most abundant mineral in your body. It is involved in muscle contractions and helps in the utilization of foodstuffs. By consuming large quantities of phosphorus, you might experience a depletion of calcium and magnesium in your bones, muscles, and organs and have weakness. Fish and poultry contain quality phosphorus.

Iron is essential in making hemoglobin or oxygen in your blood and is crucial in the transportation of oxygen during endurance activities. An intake of more than 50 mg a day for prolonged periods can be toxic. Interestingly, coffee and tea consumption can limit the absorption of iron. The best source of iron is meat. Even cooking in an iron skillet can increase the iron content in your food.

Copper helps convert iron to hemoglobin and promotes the use of vitamin C. Most foods have copper in them.

Zinc is responsible for cell growth by acting as an agent in protein synthesis. Zinc also aids in the use of vitamin A and B-complex vitamins. It prolongs muscle contractions and therefore increases your endurance. Sources include eggs, whole grains, and oysters.

Manganese is essential in numerous functions, including glandular secretions, the metabolism of protein, and brain function. Too much manganese can inhibit the absorption of iron. Food sources are tea, leafy green vegetables, and whole grains.

Sodium and potassium are minerals that need to have a balance for maximal muscular power. These minerals are needed in the transmission of nerve impulses. Deficiencies will produce cramping and weakness. Good sources are green leafy vegetables, bananas, citrus, and dried fruits.

HYDRATION

You will never perform your best unless you are properly hydrated. It is nearly impossible to set an exact general fluid requirement though.

Weather, diet, exercise, obesity, drugs, and a host of other factors affect the rate of water loss. Dehydration will drastically affect mental and physical function and performance. In some cases, when water loss is as little as 1%, physical performance can be significantly compromised.

The following guidelines are for healthy, active individuals, and they are estimated based on daily energy expenditure, provided by the International Sports Sciences Association. See Table 12.1.

Table 12.1. Minimum Daily Water Intake

Daily Energy Expenditure	Minimum Daily Water Intake
2,000 Calories	64 to 80 oz
3,000 Calories	102 to 118 oz
4,000 Calories	138 to 154 oz
5,000 Calories	170 to 186 oz
6,000 Calories	204 to 220 oz

As temperature and humidity surpass 70 degrees, fluid loss is increased. Special attention must be paid to hydration status. Many hardcore gyms have no air conditioning. For instance, the new Mecca of Bodybuilding, Metroflex Gym in

Arlington, Texas, is proud of its not having air conditioning; when heat index is factored in, this is one of the hottest areas in the world.

If you sweat profusely and for long periods, a sports drink is recommended for hydration and to replace lost electrolytes. Most athletes replace only two-thirds of lost fluids during training or competition. This is called voluntary dehydration. Due to their preferred taste, in many instances, flavored sports drinks make this phenomenon less likely.

Fluid replacement generally occurs in three distinct phases: before, during, and after exercise. Consuming a minimum of 16 ounces, two hours before intense training, increases the likelihood of optimal hydration and allows enough time for urination.

During activity, athletes need to start replacing fluids before they sense thirst. Then, they should frequently drink during training or competition at a rate of 6–8 eight ounces of fluid every 12–15 minutes.

After a workout, for every pound lost during the workout, 16 ounces of fluids should be consumed until pre-training bodyweight is restored. If this becomes an issue, implement pre- and post-workout weigh-ins. The ideal choice for fluid replacement depends on the temperature, humidity, and intensity/duration of workout.

Humidity and temperature have a great influence on the amount of fluid that should be consumed and also what type of fluids should be used for replacement. Because of this, it is important to use resources like The Weather Channel and the Internet to find out what the weather will be like so the right beverages can be provided (for instance, if a commercial sports drink is needed).

Wise athletes will pay attention to the important factors surrounding their training environment and prepare accordingly. For example, because of the humidity, temperature, and all exercises' taking place outdoors in, say, a place like Miami, profuse sweating will occur; as such, a commercial sports drink with 6%–8% carbohydrate concentration (CHO) is recommended because of lost electrolytes.

BASIC NUTRITIONAL GUIDELINES FOR THE BODYBUILDER

For bodybuilding, the classical recommendations are a diet composed of 50%–60% carbohydrates, 25%–30% protein, and 15%–30% fat.

Some nutritional guidelines literally advocate zero carbohydrates. Some take a more cyclical approach and others a more traditional approach.

With zero carbs, no matter how mentally tough you are, you will not be able to train as hard as you could with adequate carbohydrates. As mentioned earlier, fat has about 9 calories per gram, whereas protein and carbohydrates have only about 4 calories per gram.

Following a traditional approach, if you needed 3,000 calories to continue slow muscle growth during the off-season, for example, you'd be getting 450 calories from fat (15% of your daily calories), 750 calories from protein (25%), and the remaining 1,800 calories from carbohydrates (60%). Of course, these calories are divided by the number of times you eat each day (five to six times).

NUTRITIONAL GUIDELINES

Even if you or your clients do not compete, here are some considerations to help with dietary choices to help you look and feel your best.

- Eat high-quality complex carbohydrates several times throughout the day. This is a bit like an insurance policy to make sure you are getting all the energy your body requires. Consume high-quality complex carbohydrates every 2–3 hours.
- Similarly, consume high-quality protein every 2–3 hours. You are putting a great deal of stress on your muscles, and they need to repair and grow stronger. High-quality proteins are critical for muscle repair.
- Fats are an essential part of your diet. However, carbohydrates are your body's preferred energy source, and fat alone is not a sufficient energy source for high-intensity weight training.
- Eat 5–6 meals a day.
- Eat 1–2 servings of vegetables at every meal.

In bodybuilding, for years some have believed that nutrition is responsible for as much as 80%–90% of bodybuilding success.

Think about it.

If that were true, all bodybuilders would need to do is spend 80%–90% of their time on nutrition and just 10%–20% of their time on the unimportant items like going to gym, doing the right exercises in the right way at the right time with the right intensity . . . and they'd be champions. Yes, nutrition is critical, but so is training; it's at least half of the equation. You can't just simply eat your way to bodybuilding success! Champions are made by following both sound nutritional and training strategies. The key is to follow sound nutritional strategies and do your best to avoid having to bulk up too fast with a "dirty bulk" or needing to cut weight rapidly.

It is sad but true that some recreational gym lifters ignorantly dismiss the importance of nutrition. No matter what workout routine they follow, they will never look or feel their best without a sound nutritional strategy.

While three meals a day is certainly a better plan than what is followed by many sedentary folks, that strategy will not fuel a hard-training bodybuilder.

Remember, your goal is not to sustain life but to maximize muscle mass and minimize body fat. By eating one to three meals a day, you can stay alive, but your physique and strength will suffer.

You need to eat five to six meals daily, or every two to three hours. This allows your body the necessary amount of time to use, digest, and oxidize the nutrients in the meal.

Additionally, spreading out your calories steadily throughout the day, over five or six meals, will decrease the chances that excess calories will be converted to fat and that your body will cannibalize your muscles for the nutrients it lacks.

Eating meals more frequently will cause your metabolism to speed up and minimize body fat while helping maximize muscle and strength gains.

NUTRITIONAL GUIDELINES FOR MAXIMIZING YOUR PHYSIQUE AND PERFORMANCE

Remember, diet is not just 12–16 weeks before a contest. It's a long-term commitment to make a part of your lifestyle. Your eating habits will either support or sabotage your training efforts. Science can show you how; your job is to take advantage of this knowledge and reach the next step of your maximum hypertrophy and minimal body fat.

Calorie Expenditure: The number of calories a person burns in a day.

Calorie Expenditure

A computer programmer burns far fewer calories at work than someone performing heavy manual labor. Let's look at some of the energy expenditures that different activities require from some of the research Dr. Fred Hatfield compiled and the table he derived.

Basal energy expenditure (BEE), or basal metabolic rate (BMR) as it is sometimes called, is the energy requirement to maintain life. It is measured at rest, but not sleep, in a thermo-neutral environment in the post-absorptive state. It can be measured directly or indirectly, or it can be estimated as we are doing here: we are using the 1919 equations of Harris & Benedict. The Harrris-Bendict Studies on Human Basal Metabolism: History and Limitations was a 1998 study published in the Journal of American Dietetic Association confirming the accuracy of the Harris-Benedict equation.

The caloric costs shown in the next table are based on one's lean bodyweight (LBW means fat-free weight). The simple logic for doing this is that for any given bodyweight, the person with the lowest percentage of body fat is going to burn more calories.

Bigger muscles burn more calories than do little ones. Thus, the assumption is made that for any given LBW in the tables below, the BEE is based on an average person with an average percentage of body fat.

Because the Harris-Benedict equation uses total bodyweight, we are assuming, for example, that a woman with 100 pounds of lean bodyweight, and with 20% body fat, actually weighs 125 pounds. And a man with 170 pounds of lean bodyweight, and with 15% body fat, actually weighs 200 pounds.

Men: **BEE = 66.5 + (13.75 × W) + (5.003 × H) – (6.775 × A)**

Women: **BEE = 655.1 + (9.563 × W) + (1.850 × H) – (4.676 × A)**

W = actual weight in kilograms (1 kg = 2.2046 pounds)
H = height in centimeters (2.54 cm = 1 inch)
A = age in years

Obviously, there is more to life than merely resting in that temperature-neutral environment. You must also have energy from your diet to support your activities above basal.

Once you have determined your BEE, you must estimate your actual metabolic rate. You do this by computing how many minutes you spend

in your various activities each day and adding the total caloric cost of these activities to your BEE.

To simplify this task, we have divided calorie-burning activities into five levels from very light to very heavy. The results you derive are only an estimate, but they should nonetheless give you an idea of your daily caloric needs. See Table 12.2.

The higher your body fat percentage, the fewer calories you'll burn (lower activity level and less muscle to burn calories). The lower your body fat percentage, the more calories you'll burn. (Bigger muscles burn more calories than little ones do). Thus, it becomes much easier to get rid of fat permanently by increasing your metabolic rate.

You do this by increasing both your muscle mass and your activity level.

You can (and *should*) gain muscle mass and lose fat at the same time. Never sacrifice muscle tissue during the fat-loss process. Instead, build more muscle to burn more calories. You'll lose more fat faster, and you'll be more likely to keep it off.

The *key* is to control your calories!

Table 12.2: Caloric Cost of Physical Activity

Sedentary	Fitness buff	Hard-training athlete		
Very light	Light	Moderate	Heavy	Very heavy*
1.2–1.3 x BEE	1.4–1.5 x BEE	1.6–1.7 x BEE	1.8–1.9 x BEE	2.0+ x BEE
Reading Sitting Driving Eating	Walking Sweeping Playing piano Bicycling (easy)	Fast walk Dancing Ping-Pong Skating Light weight training	Swimming Running Bicycle race Basketball	Boxing Rowing Mountain climbing Intense weight training

* The caloric cost of highly intense activities such as Nordic skiing or marathon running may be more than double your BMR.

Average daily activity level. To estimate your average activity level for a 24-hour period, read the following instructions and Table 12.3. You will easily be able to approximate the percentage that most closely describes your lifestyle. This percentage is used in the daily caloric expenditures shown in Table 12.4.

Instruction. For each of the 24 hours in one of your "average" days, determine your energy expenditure by reading the descriptions in Table 12.3. Then calculate your hourly BEE (BEE divided by 24) and multiply your hourly BEE by your energy expenditure.

For example, if your hourly BEE equals 85 calories, and your activity level during that hour was light (1.3), then you simply multiply

Table 12.3: Energy Expenditure Guide

Multiplier	Activity Description
0.8	Sleeping
1	Lying down completely relaxed but not sleeping (your "basal metabolic rate" or "basal energy expenditure)
1.2	Very Light: sitting, studying, talking, little walking or other activities
1.3	Light: typing, teaching, lab/shop work, some walking
1.4–1.6	Moderate: walking, jogging, gardening type job
1.7–1.8	Heavy: heavy manual labor such as digging, tree felling, climbing
1.9–2.0	Exceptionally Heavy: fitness-oriented cycling or similar vigorous activities, weight training, aerobic dance
2.1–2.2	Sports: vigorous sports competition such as football, racquetball, tennis, or other extended-play sports activities
2.3–2.4	All-Out Training: extremely high-intensity weight training with little rest between sets or exercises
2.5	Extended Maximum Effort: extremely high-intensity and high-duration sports competition such as triathlon, cross-country skiing, or marathon

85 times 1.3. Your hourly caloric expenditure equals 110.5 calories.

Do this for each hour of the day, add them all together, and that is your daily caloric requirement (your metabolic rate). Be sure to apportion your daily calories over at least five meals, with each meal reflecting your *upcoming* caloric needs.

For example, if you expect to train, eat more; if you expect to take a nap, eat less.

The caloric expenditures listed in the table below are for people with about a 20% body fat level. The less muscle mass you have, the fewer calories you'll burn. The more muscle you have, the more calories you'll burn.

That means that the higher your proportion of fat is to your total bodyweight, the fewer calories you'll burn. In contrast, the greater your proportion of muscle to your total bodyweight, the more calories you'll burn.

Remember that strenuous exercises with weights (including, but not limited to, dumbbells and barbells, even machines, your own bodyweight, and other forms of resistance exercises) are the best way to increase your muscle mass, thereby increasing your metabolic rate.

This will result in far more calories being burned all day long—even at night while you're sleeping. This, in turn, makes it easier to keep your body fat level in check. See Table 12.4.

Table 12.4. Approximate Hourly Caloric Cost of Activities According to Bodyweight

	Weight in Pounds								
Activity	**100**	**125**	**150**	**175**	**200**	**225**	**250**	**275**	**300**
Light aerobics	104	154	204	254	304	354	404	454	504
Walking 2.5 mph	104	154	204	254	304	354	404	454	504
Gardening	118	168	218	268	318	368	418	468	518
Golf	145	195	245	295	345	395	445	505	545
Lawn mowing	145	195	245	295	345	395	445	505	545
Light calisthenics	172	222	272	322	372	422	472	522	572
Light weight training	172	222	272	322	372	422	472	522	572
House cleaning	172	222	272	322	372	422	472	522	572
Walking 3.75 mph	199	249	299	349	399	449	499	549	599
Swimming 2.5 mph	199	249	299	349	399	449	499	549	599
Medium aerobics	240	290	340	390	440	490	540	590	640
Badminton	247	297	347	397	447	497	547	597	647
Wood chopping	294	344	394	444	494	544	594	644	694
Medium weight training	342	392	442	492	542	592	642	692	742
Slow jogging	376	426	476	526	576	626	676	726	776
Heavy calisthenics	444	494	544	594	644	694	744	794	844
Heavy aerobics	444	494	544	594	644	694	744	794	844
Heavy weight training	512	562	612	662	712	762	812	862	912
Medium jogging	512	562	612	662	712	762	812	862	912
Cycling 13 mph	560	610	660	710	760	810	860	910	960
Fast jogging	580	630	680	730	780	830	880	910	960

Eat at Least Five Meals a Day

Two or three meals simply are not enough. If your body is not getting the calories it needs through your meals, where will energy come from? Muscle tissue!

That's right—the same muscle tissue you spent weeks and months sweating for in the gym. The body is a conservative machine, and it won't grow unless (a) you give it a reason to (through weight training) and (b) you provide plenty of calories so that the body is convinced it can afford to add more lean mass.

Caloric Distribution

Calories must be ingested according to your upcoming activity level. Therefore, prior to every meal, ask yourself, "What am I going to be doing for the next three hours?"

If you plan to sit at a desk at work, eat less. However, if you plan to train, eat more. By carefully manipulating your caloric intake this way, meal after meal, day after day, week after week, month after month, pretty soon you'll look in the mirror and see something you've been waiting to see for a long, long, time: a well-defined, muscular physique.

Guidelines for Bulking

"If you cannot see abs or veins on your arms and legs, you are getting too fat!" Branch Warren once exclaimed in a conversation with me.

Rules such as "Never exceed 15 pounds over your competition bodyweight" generally are rendered useless. The look and size of a bodybuilder can be an illusion, and Branch's words of wisdom ring true. Adding muscle mass is important but never at the expense of getting fat.

Dieting is tough enough, and excess body fat will require an aggressive crash-course strategy to be competition ready—most likely dieting away the extra muscle or being in a prolonged state of caloric deficit. Neither of these scenarios is conducive to maximizing muscularity.

Here is a sensible guideline for bulking:

Add 2 calories per pound of bodyweight to your daily caloric intake.

The added calories should come from all macronutrients; a minimum of 1 gram of protein per pound of bodyweight should be consumed.

Spread these added calories equally among 5 meals per day.

For example, people weighing 150 pounds should add 300 calories per day to their diet over 5 meals, which equals about a 60-calorie increase per meal.

The additional 300 calories will, with intense weight training, result in a gain of approximately 1–2 pounds of added muscle per month.

Reduce your caloric intake 2 days per week by 2 calories per pound of bodyweight. (To ensure that excess fat is being removed, this should be on non-training days.)

Right after a show or after a long diet is the best time to bulk because your body will act like a sponge, absorbing nutrients with maximum efficiency. This natural rebound effect, coupled with heavy training, will synergistically promote anabolism.

Fat Loss Guidelines

One pound of fat contains 3,500 calories. The logical assumption would be to reduce your caloric intake by 500 calories daily. Thus, $7 \times 500 =$

3,500 calories, so you will lose a pound of fat per week and be lean and mean in no time, correct?

Hold on . . . not so fast.

Your body tends to use "excessive" muscle tissue for energy before fat. As you drop weight and lose muscle, your caloric needs will drop. This is why *calories must be cut very slowly*!

Follow these guidelines:

- Subtract 2 calories per pound of bodyweight from your daily caloric intake.
- The reduced calories should come mostly from carbohydrate and fat calories and not protein. Eat minimally 1 gram of protein per pound of bodyweight.
- This caloric reduction should be applied to all your meals; do not reduce the frequency of meals.

For example, assuming a bodyweight of 150 pounds and that you're eating 5 meals per day (highly recommended), you should reduce each meal by 60 calories (total of 300 calories' reduction over a full day).

By reducing your daily caloric intake by 300 calories, you can expect to lose about 2.5 pounds of fat per month, assuming you're weight training for muscle-mass preservation or increase.

Increase your caloric intake 2 days per week by 2 calories per pound of bodyweight to ensure that you're getting enough calories to put on lean muscle and that upward BMR adjustments are being made. This is the concept of the Zigzag diet explained in the next subsection. Even carb cycling, Body Opus, etc. follow this premise. Although carbs are the macronutrient cycled, caloric intake is not linear.

Zigzag Caloric Approach

Trying to gain muscle and lose fat at the same time is difficult. The Zigzag diet, the brainchild of Fred Hatfield, was designed for this purpose. This strategy is designed to yield results over time.

Here's how it works: Let's say you presently weigh 240 pounds, your body fat is 20%, and your goal is to weigh 250 with 10% body fat. Very simply, you up your caloric intake for four to five days and then cut back for a day or two. In this way, you gain (approximately) a pound of muscle and a pound of fat, and then lose the fat, retaining the muscle.

If you are trying to lose both weight and fat, simply reverse the Zigzag procedure just discussed. Reduce your caloric intake for four to five days and then bring it back up to normal levels for a day or two. If you have been eating at least five times daily, fat storage enzymes will be at very low levels.

By reducing caloric intake for four to five days, you will put your body in a caloric deficit. This, in turn, will cause a reduction in body fat. However, if you remain in a caloric deficit for too long, your BMR will be reduced, thus making further fat loss more difficult. By increasing caloric intake for one to two days every week, your BMR will remain at a constant level even though fat loss is occurring on the other days of the week when your are in a caloric deficit. This strategy will allow for fat loss to continue smoothly for a long period of time without causing a dramatic reduction in BMR.

INTRA- AND POST-WORKOUT NEEDS

Intra-Workout Nutrients

Intra-Workout: During workout.

The authors of *Nutrient Timing* break the day down into three phases: energy phase, anabolic phase, and growth phase. The *energy phase* is when you need fuel during a workout: Your body's acute hormonal response to weight training is increased GH, IGF-1, and testosterone secretion, but not all anabolic hormones are abundantly increased; insulin concentrations are reduced, and increased skeletal blood flow occurs.

When you exercise, the following acute catabolic effects take place: increased cortisol levels, decreased net protein balance, depleted glycogen, depleted insulin, and increased metabolic rate.

The idea is to counteract these effects but maximize the anabolic ones. This can be aided by consuming a sports drink that contains branch-chain amino acids (BCAAs) during your workout. BCAAs have also been shown to reduce fatigue in hard-training anaerobic athletes—that is, the bodybuilder. It has also been noted that leucine may be the most critical BCAA because of its anti-catabolic properties and vital role in protein synthesis.

World-renowned William J. Kraemer led a study showing that, in a state of overreaching for two weeks, strength performances were not compromised for a control group supplementing with BCAAs, whereas strength performances were significantly compromised for the group taking a placebo.

Purposeful overreaching is a component of many periodized bodybuilding training plans. Supplementation with BCAAs has huge implications for performance, which indirectly aids in the acquisition of hypertrophy. Countless other studies confirm the effectiveness of BCAAs.

Post-Workout Nutrients

Post-Workout: After your workout is completed.

The *anabolic phase* lasts up to 90 minutes post workout. This is when your muscle cells are ready to grow; if your muscles are fed with the right nutrients post workout, abundant muscle growth will take place; if they are not, catabolism will be magnified and prolonged—not a good thing!

Insulin sensitivity and glucose tolerance peaks post workout, so up to 2 grams of carbohydrate per kilo of bodyweight and 0.5 grams of protein per kilo of bodyweight can be consumed.

This means for a 220-pound (100 kg) bodybuilder, this would be 100 × 2 = 200 grams of carbohydrates, and 100 × 0.5 = 50 grams of protein. This would look like 200 grams of carbohydrates + 50 grams of protein = 250 grams, and 250 grams × 4 calories = 1,000 calories. This is a great number of calories and carbohydrates, so when you employ this strategy, carbohydrates will need to be reduced throughout the rest of the day. This recommendation is on the extreme high end. Obviously, when cutting weight, it is important to pay attention to calories in versus calories out.

What about the Rest of the Day?

A couple of hours after the completion of training, while the anabolic window is not wide open, carbohydrates do not need to be consumed to excess because of the intra-workout and post-workout consumption of fast-acting carbs. A majority of glycogen stores are restored. Throughout the rest of the day, a 1:1 protein-to-carbohydrate ratio can be consumed, along with complex carbs with a lower glycemic index (GI) rating.

A FEW LAST WORDS

Here are some final guidelines:

1. **Never experiment with new or unusual (for you) foods as a show approaches.** If you do, you may discover a food that does not agree with you at the worst possible time. Instead, stick with familiar foods that work well for you. As stated earlier, low-glycemic carbs are best, exceptions being intra workout and immediately post workout.
2. **Don't try to fix things in the short term.** If you have excessive body fat, you will not magically become lean by popping a diuretic. It's what you eat over the long term that really counts.
3. **Take pride in developing a personal discipline when it comes to nutrition.** Many, many recreational bodybuilders are highly disciplined when it comes to training but poorly disciplined in terms of nutrition. One facet of this discipline involves meal planning. Little is written about the fact that to eat properly, you must plan your meals. Many athletes use excuses such as "At work, I just don't have access to good food," or "I'm always so busy." The list goes on and on. All of these problems can be solved through planning. Bring a cooler to work or buy a small refrigerator. Cook up some chicken breasts and eat them throughout the day. Use meal replacement shakes—an easy, low-preparation way to eat well at work. Or use workout bars as an occasional meal when time is tight. The options are numerous if you take the time to plan.
4. **If you have not already done so, buy a measuring cup and a scale.** You will need to measure carbohydrate grams, protein grams, and fat grams. This is tedious and time consuming. You will need to use http://www.calorieking.com to find the values for each food. If you are preparing for a contest, you need to weigh your food!

Remember, one of the biggest factors to this whole equation is genetic potential. It is hard to make a pit bull out of a poodle. No matter what cards you have been dealt genetically, if you put forth your best effort and follow the presented guidelines, you can still reach your potential.

Heredity may have been the dealer, but nutrition and training will play the hand! As the saying goes, "Hard work beats talent when talent doesn't work hard.

TOPICS COVERED IN THIS UNIT

Which Supplements Do You Need?

Drugs in Bodybuilding

- Anabolic and Androgenic Steroids (AAS): What They Are and How They Work
- Fat-Loss Drugs

A Few Last Words

UNIT 13

SUPPLEMENTS AND DRUGS

In today's world, it is simply impossible for athletes to eat properly all the time, even under the best of circumstances. That's why many athletes supplement their food intake.

Thousands upon thousands of different supplements claim to do everything from increasing the size of your muscles to curing cancer. That is the nature of the supplement industry, to make bigger claims than the company before it did to gain a share of the marketplace. Sadly, the supplement companies are now in essence marketing machines rather than science-based companies seeking to develop a new and effective product. More money is spent on advertising to the target audience than on actual research and development. The information is provided not to demonize the supplement manufacturers but to raise your awareness and, we hope, to save you time and money. Like in all things, if it sounds too good to be true . . . it probably is!

WHICH SUPPLEMENTS DO YOU NEED?

Now that I have alerted you about supplement companies, let's look at some supplements that do work and that should be a part of a bodybuilder's regimen.

If you are getting your nutrition from real food (which you should be), then the list of supplements you should be taking is pretty short. Entire books have been written on supplementation. Therefore, we are only going to cover the supplements that are essential to the bodybuilder. The following describes some basic supplements that may be a helpful adjunct in your training.

- For starters, I always recommend taking a good quality **multivitamin**. The multivitamin (and your diet) should provide you all the vitamins your body needs to operate efficiently.
- The next most basic supplement I always prescribe is a high-quality, multi-blend **protein powder**. For those who can't just train and eat all day, it becomes a chore to get a sufficient amount of protein from food sources daily. As such, the protein powder allows us to get in a quick 40–60g of protein. And while we're on the subject of protein, it might pay to investigate the abundance of weight-gain shakes currently available. For athletes trying to add muscle mass, these shakes can be invaluable.
- **Antioxidants** are substances that protect against free radicals, highly unstable molecular fragments unleashed by strenuous exercise, chemicals, polluted air, and other factors, which can cause extensive

Antioxidants: a substance such as vitamin C or E that removes potentially damaging oxidizing agents in a living organism.

Branched-chain Amino Acids: An amino acid having aliphatic side-chains with a branch (a central carbon atom bound to three or more carbon atoms).

Coenzyme Q10: An antioxidant.

Creatine Monohydrate: A nitrogenous organic acid that occurs naturally in vertebrates. Its main role is to facilitate recycling of adenosine triphosphate (ATP), the energy currency of the cell, primarily present in muscle and brain tissue.

Glucose Polymers: The more densely branched glycogen, sometimes called "animal starch."

L-Glutamine: An alpha-amino acid that is used in the biosynthesis of proteins.

damage to the body. Free radicals are involved in emphysema, wrinkled skin, cancer, blood clots, and damage to cellular components and DNA along with muscle pains, cramps, fatigue, and a host of other ailments and diseases normally associated with aging. Free-radical "scavengers" (another term for antioxidants) include vitamins A, C, and E, selenium, zinc, many different botanical preparations such as Maria thistle, pycnogenol and nordihydroguairetic acid (NDGA from chaparral), glutathione, and others.

- **Branched-chain amino acids**, in supplement form, consist of leucine, isoleucine, and valine, which compose an overwhelming majority of the aminos your body needs for more rapid and complete recovery, repair, and growth resulting from adaptive exercise stress. They must be taken in the right ratio (2:1:1, respectively). Countless studies confirm the effectiveness of BCAAs. See the next unit for more information about BCAAs.
- **Coenzyme Q10**, also called ubiquinone, it is a naturally occurring biochemical within the cells' mitochondria. Specifically, it acts as an electron carrier in the production of ATP (Adenosine-5'-triphosphate). As a supplement, it is believed to be (a) a potent antioxidant, (b) an immune system booster, (c) an energy enhancer, (d) an aid in preventing cardiac arrhythmias and high blood pressure, and (e) a performance enhancer for aerobic athletes, particularly if the athlete is in less-than-peak condition.
- **Creatine monohydrate** has been clinically used in improving plasma creatine concentrations by as much as 50%. Research shows this substance to be effective in improving training intensity and recovery and even increasing satellite cell proliferation. It is able to pass through the stomach wall and into the bloodstream intact and, upon entering the muscle cells, is converted into creatine phosphate (CP). For decades, studies have confirmed the effectiveness of creatine.
- **Glucose polymers** are a low glycemic carbohydrate supplement that delivers a steady source of energy for workouts and restoration. "Branching" glucose polymers (i.e., glucose molecules consisting of differing glycemic indexes due to their structural complexity) are available as drinks, powders, and tablets.
- **Inosine** is a naturally occurring compound found in the body that contributes to strong heart muscle contraction and blood flow in the coronary arteries. As a supplement taken before and during workouts and competition, it stimulates enzyme activity in both cardiac and skeletal muscle cells for improved regeneration of ATP. What this means in training terms is that you'll be able to get a rep or two more out of yourself in each set. It also means that you'll be able to do drop sets with greater stamina. Better workouts equal better gains.
- **L-glutamine** is converted by the liver from glutamic acid, in combination with vitamin B6; ammonia, a toxic byproduct of amino acid breakdown, is scavenged in the process. Lymphocytes and other white blood cells, frontline fighters in the immune system, are strongly dependent on glutamine. Glutamine also helps memory and concentration and aids in neutralizing the catabolic effects of cortisol, which is released during strenuous exercise.
- **Octacosanol** is the active, energy-boosting component of wheat germ oil, which is known to improve endurance, reaction time, and muscle glycogen storage. It's taken as a supplement.
- Many **pre-workout supplements** exist; however, numerous studies confirm the effectiveness of caffeine on maximum strength

and on muscle endurance. With pre-workout supplementation like high dosages of caffeine, your body will adapt quickly, so initially you can just keep increasing the dose (which is not good), but eventually, this will no longer work. Cycle on and off pre-workout supplements. Deload weeks are a great chance to cycle off stimulants and pre-workout formulas.

A final note: Use caution when investigating the wide array of exotic-sounding miracle supplements with supposed steroid-like effects. They usually have no proven benefit for hard-training athletes and can sometimes have more severe side effects. The pharmaceutical industry is regulated, but the dietary supplement industry is not.

DRUGS IN BODYBUILDING

Home run records being broken; mysterious jumps in performance marks of Olympic sports by 10%–15% from the 1950s to 1960s; professional bodybuilders weighing close to 300 pounds shredded; female bodybuilders with muscle size, density, and cuts that would literally wipe the stage clean of a 1980-era Frank Zane; raw strength records being broken with stunning regularity. Besides advancements in training methods, scientific advancements in nutritional strategies and recovery modalities, a desire to be the best, and athletes working harder and harder and their sports becoming their careers, what do all of these have in common? The answer is drugs.

The history of drugs and athletic prowess goes back a long way.

The Viking Berserkers used to take hallucinogenic mushrooms prior to going into battle to destroy their opponents.

As early as 1865, Dutch swimmers were using stimulants to enhance performance.

In 1886, Welsh cyclist Arthur Linton died after winning a race, having taken a stimulant trimethyl for a competitive edge.

In 1889, a 72-year old French physician extracted testicular fluid from dogs and guinea pigs, injected himself with it, and reported feeling much younger.

In 1935, a team of German scientists developed synthetic testosterone to treat men with hypogonadism. As World War II progressed, the German scientists realized that synthetic testosterone not only would help soldiers who were malnourished but also would increase the soldiers' athletic performance and aggression.

Today, a booming multibillion-dollar hormone replacement therapy (HRT) industry is thriving by giving synthetic testosterone to a generation of middle-aged and senior men combating andropause, resulting in these men reporting a new feeling of virility and well-being with minimal (if any) negative side effects.

After World War II, Eastern Bloc weightlifters began to dominate Olympic weightlifting, and Soviet wrestlers were extremely successful in the 1956 Olympics. This was not only because of advanced training techniques but also because these athletes were using anabolic steroids.

John Ziegler was an American physician who loved barbell training and bodybuilding. He frequently trained at York Barbell Club and made friends with top weightlifters in the United States. The World Weightlifting championships in 1954 were held in Vienna, Austria, and because of his interest in the "iron game," John Ziegler was selected as the team physician and traveled to Austria with the team.

While there, Ziegler saw the Russians dominate the event and set many records. The massive, extremely muscular and hairy physiques of the

Russians made the American weightlifters appear like little boys by comparison.

This piqued Dr. Ziegler's curiosity, so he invited the Russian team physician out for a night on the town.

The story has it that as the vodka was flowing during the evening, the Russian physician became inebriated, and that's when Dr. Ziegler saw an opportunity to ask the Russian what the team's secret was. The Russian doctor revealed that the Russians had been building strength and muscle with testosterone.

After that night, Dr. Ziegler knew that to put the Americans on an even international playing field, they would have to use testosterone in their training regimens.

Bob Hoffman, coach and owner of York Barbell Club, gave Dr. Ziegler access to his team.

Ziegler began to experiment with straight testosterone shots to weightlifters and bodybuilders at Hoffman's club, yet the measure proved unsuccessful. Nonetheless, this "temporary setback" didn't discourage Ziegler in his pursuit of developing a "wonder" drug.

In 1958, he collaborated with Ciba Pharmaceuticals and created Methandrostenolone, also called Dianabol, and referred by some to this day as "D-bol."

Dianabol proved to work quite well, and American weightlifters were once again competitive on the international scene.

Ziegler claimed this was because of the isometric training system he had developed. However, those who used his system without Dianabol were disappointed in the results.

Even today, more than 50 years later, many argue that Dianabol is still the most effective steroid available. "Dianabol, the breakfast of champions," became a phrase jokingly used among hardcore iron junkies in the 1970s.

Since the 1950s, steroids have gained in popularity. They were not banned until the 1976 Olympics, and even with the ban, many athletes have easily circumvented testing protocols.

The NFL did not test for steroids until 1986, and the NCAA did not test until the late 1980s. Many anecdotal reports from ex-NFL players, and NCAA athletes, report that Dianabol was openly a part of the athletes' training protocols until these organizations effectively banned them.

Major Division One football programs had strength coaches arrested for distribution of anabolic steroids in the 1980s. The late Steve Courson, who died in 2005 in a tragic accident in which he was hit by a falling tree, claimed that, during his time in the NFL in the 1970s and 1980s, *half of all players* used anabolic steroids.

This may seem high, but in private, off-the-record conversations I have had with former NFL players from this era, they claimed that the number is closer to *90%*, with the exceptions being kickers and some quarterbacks. Even quarterback legend Terry Bradshaw has openly admitted to using steroids.

Critics claim that Courson embellished this figure to promote his book *False Glory* because he could no longer play in the NFL. Courson blew the whistle on NFL steroid users in a 1985 edition of *Sports Illustrated*. Many credit Courson and the *Sports Illustrated* article as monumental in the implementation of the NFL's drug testing policy. We will never know whether Courson's intentions were pure, hoping to protect his peers in the NFL, whether he was trying to rain on a party he could no longer be a part of, or whether he simply was after financial gain.

Today, most major sports test for steroids and other performance-enhancing drugs (PEDs). However, in bodybuilding and powerlifting, some contests test for anabolic steroids and others do not.

Here is a list of some drug-testing bodybuilding organizations with their websites; visit naturalbodybuildingevents.com for updated lists of contests:

- DFAC—Drug Free Athletes Coalition: drug-freeathletescoalition.com
- NPAA—Natural Physique & Athletics Association (based in Alberta, Canada): npaa.ca
- ABA/INBA/PNBA—Amateur/International/Professional Bodybuilding Associations (Presents Natural Olympia): naturalbodybuilding.com
- ABBCI—Fédération Ivoirienn e de BodyBuilding & Disciplines Associées: AfricanMuscle.com
- ABFF—Alaska Bodybuilding, Fitness and Figure: alaskabodybuilding.com
- ANB—Australasian Natural Bodybuilding: anb.com.au
- BNBF—British Natural Bodybuilding Federation: bnbf.co.uk
- Executive Productions: epfnb.org
- Fitness Atlantic: FitnessAtlantic.com
- FAME World Tour: FAMEworldtour.com
- IDFA—International Drug Free Athletics: canadian-classic.com
- IFPA—International Fitness & Physique Association: thenaturalmusclenetwork.com
- INBA Australia—International Natural Bodybuilding Association (Australia): inba.com.au
- Model World Tour: modelworldtour.com
- Musclemania World Tour—The Natural Choice of Champions: musclemania.com
- NANBF—North American Natural Bodybuilding Federation: nanbf.org
- NASF—North American Sports Federation: nasfironsports.org
- Natural Muscle Association: naturalmuscle.com
- NBFI—Federazione Natural Bodybuilding & Fitness Italy: nbfi.it
- NBON—Natural Bodybuilder Organizations of Nigeria: nbonbuildersworld.com
- Neutron Fitness & Sports Organization: neutronsports.com
- NPA—Natural Physique Association (United States): siflexphysique.com
- NPA—Natural Physique Association (United Kingdom): npabodybuilding.com
- NGA—National Gym Association: nationalgym.com
- P3 Entertainment: p3ent.com
- SNBF—Supernatural Bodybuilding & Fitness: snbf.com
- UFE—Ultimate Fitness Events: UFEshows.com
- UIBBN—Union Internationale de Body Building Naturel: uibbn.free.fr
- USBF—United States Bodybuilding Federation: usbf.net
- WNBF—World Natural Bodybuilding Federation: inbf.net

An important note: Even the most well-known bodybuilding organization, the NPC, the gateway organization to the IFBB, offers natural contests. Promoters such as Dave "the Texas Shredder" Goodin have done a fantastic job of keeping this aspect of the NPC alive and vibrant. Let's hope it continues.

ANABOLIC AND ANDROGENIC STEROIDS (AAS): WHAT THEY ARE AND HOW THEY WORK

Anabolic and Androgenic Steroids: Synthetic substances related to the male sex hormones (androgens.) The anabolic effects of the drugs promote the growth of skeletal muscle, and the androgenic effects promote the development of male sexual characteristics.

For the public, AAS are simply referred to as steroids. Common slang names for steroids in gyms include "juice," "sauce," and "gear." AAS are synthetic derivates of the hormone testosterone. Some are taken orally, whereas others are injectable. Injectables can be water or oil based. Oil-based steroids generally have much longer half-lives and, therefore, call for less frequent injections.

AAS essentially act as the male sex hormones of testosterone and di-hydrotestosterone. Steroids have been shown to increase protein synthesis in cells. In turn, a buildup of cellular tissue in the muscles takes place. In other words, they are anabolic (hence the name "anabolic steroids"). AAS have been shown to cause masculine properties on male and female users, including the deepening of the voice, balding, and the growing of additional body hair.

Types of Anabolic Steroids

Athletes ingest AAS three ways. The first way is orally. This might come in a pill, capsule, or even in liquid form. Oral administration seems to be the most attractive route for many novice steroid users because of its simplicity. Unfortunately, it may be the most harmful way to ingest steroids.

To make oral steroids effective, they must be c17 alpha alykated. This means the drug is altered and is protected from deactivation by the liver. This allows the drug, in near entirety, to enter the bloodstream. The problem with this is that it is toxic to the liver and kidneys. Some researchers believe this may even promote the development of liver cancer.

I want to make an important statement: the ISSA does not condone and highly discourages the use of illegal steroids.

However, if you or anyone you know is taking oral steroids in any amount, make sure he or she is getting regular check-ups and blood tests from a physician. If used, these compounds should be done so for a maximum of five to six weeks, or the chance of serious bodily harm may be greatly enhanced.

Although athletes us many types of oral steroids, the two most common ones used to add muscle and strength are Dianabol and Anadrol-50. Both of these oral compounds are very toxic, although in some people, they may work well for gaining strength and muscle size.

John Ziegler limited his athletes to less than 20 mg daily. I have known people personally who have used in excess of 500 mg daily. Such overuse and misuse is extremely dangerous.

The Soviet Sports Machine did not subscribe to any sort of regulations. Its objective was results and not the athlete's safety. Its studies showed Dianabol achieved its maximum effect at a dose of 0.5 mg per kilogram of bodyweight. For a 220-pound athlete (at 100 kg), this would be 50 mg daily. Make no mistake, this is an incredibly hefty dosage, but it's only one-tenth of what some American bodybuilders and powerlifters have done. Dosages of this magnitude completely disregard science and health.

Furthermore, it is not productive to follow such misguided actions to achieve the best results! Your body will function subpar if you walk around feeling like a toxic waste dump and your liver and kidneys are working overtime just to combat the excessive drug toxicity. The opposite of what an athlete needs.

Anavar and Halotestin are two oral steroids used by athletes hoping to increase strength without adding the excessive muscle bulk that might drive a powerlifter into a higher weight class or by bodybuilders attempting to harden up prior to a show.

Bodybuilding men generally take 20–50 mg of Anavar daily and women take 5–15 mg daily. Halotetsin is generally used by bodybuilders for periods of less than four weeks in a dosage of 20–30 mg daily.

Although Anavar is much less toxic than other oral steroids are, it, like other PEDs, is still toxic. Contrary to what you read on many pro-steroid websites, Anavar, like other oral compounds, can cause serious side effects.

Many believe that Halotestin is the best steroid for increasing strength. Moreover, it does not cause the user to retain water. However, Halotestin can cause a large increase in aggression.

And that's not all.

Halotestin is considered the most toxic oral compound available.

Let me emphasize again: Using steroids is discouraged, especially using the highly toxic Halotestin!

Some oral steroids are primarily used to increase aggression. Two of them are methyltestosterone in pill form and cheque drops in liquid form, taken sublingually. Although both bodybuilders and powerlifters have been known to use them, these compounds are both potentially quite toxic.

The most popular injectable steroid for increasing strength/bodyweight ratio for powerlifters is Trenbelone (also referred to as Finaplix). For bodybuilders, Trenbelone gives the user a very hard and ripped appearance, and it greatly increases aggression. Many users have trouble breathing while using this highly toxic compound. Reportedly, Trenbelone has higher incidents of erectile dysfunction and testicular atrophy than other AAS compounds do.

WinstrolV is a water-based injectable steroid. Ben Johnson was caught using WinstrolV in the 1988 Olympics when he set the world record in the 100-meter dash. Boxers, sprinters and, of course, bodybuilders looking to shed fat have used WinstrolV. WinstrolV is considered to yield much milder side effects than many other compounds do. Nonetheless, it still has side effects and is a powerful drug. Do not believe that Winstrol is harmless! Anecdotally, many users with a predisposing condition to elevated levels of cholesterol report WinstrolV induces this condition more rapidly than other anabolic compounds do.

There are many types of injectable testosterones

from the long-acting, oil-based Sustanon-250 blend. They range from Testosterone Cypionate, which can be detected months after use, to the short-acting, water-based testosterone that cannot be detected even three days after the last use.

Even if you aren't concerned about the harmful side effects of synthetic testosterone, remember that you are still injecting your body with a synthetic hormone that effectively shuts down your own natural production of testosterone. Does that sound like a good idea to you? This may not kill you right away or even cause a premature death, but it does temporarily throw your body out of homeostasis (*never* a good thing!).

Evaluating the Risk-to-Benefit Ratio of AAS

Since the late 1950s, the coaching and medical communities have spoken of the dangers of anabolic-androgenic steroids (AAS) for athletes. Authorities believe that the non-medical use of AAS causes many adverse side effects, some that might not be reversible.

These side effects include liver tumors, jaundice, fluid retention, high blood pressure, increased cholesterol levels, and enlargement of the heart. Other side effects for men may include shrinkage of the testicles, reduced sperm count, infertility, baldness, and growth of breast tissue. Some believe that steroid users may suffer psychological defects such as paranoia, excessive jealousy, delusions, and uncontrollable "'roid rage."

Research has clearly demonstrated that steroids have terrible side effects in adolescents and women, but how do steroids affect healthy men?

Advocates of AAS use for non-medical reasons believe that steroids have many benefits with very little risk. These benefits are cosmetic improvements, strength gains, increased libido, increased sense of well-being, ability to work harder/recover faster, and possible life extension. They also point to longevity and life-extension clinics that prescribe testosterone to people in hope of extending the lives of their patients with low testosterone levels.

When testosterone levels are optimized under the care of a physician, it is likely that this patient will receive these benefits. The increased levels of testosterone have been associated with increased energy, increased aggression, improved ability to learn and retain information, and the ability to take risks. All these factors would contribute to a robust, free-market economy. *Psychology Today* has discussed the topic of testosterone's not only increasing aggression but also improving self-confidence, improving the desire to become a leader, and enhancing competitiveness. Both sides in the steroid debate seem extremely passionate and emotional.

But what if we look past the emotion and examine what science says?

Are steroids safe in moderation for non-medical use? It is difficult to say with 100% confidence at this point.

Not enough long-term research has been conducted, and most of our evidence is anecdotal from former users. Although former users are not dropping dead at an alarming rate, this does not mean steroids are safe. Any time medicine is used for non-medical use, while not under a doctor's supervision, there is a risk of serious side effects. Most would agree that drinking a bottle of whiskey a night could be harmful to one's health; however, having a beer with dinner will not kill you. When it comes to the safety of steroids, many experts believe these factors are influenced by the type, the dose, the duration of use, and whether the user has preexisting

conditions. People need to look closely at potential health risks and legal consequences before deciding to use AAS.

From a performance standpoint, both studies and anecdotal evidence have shown steroid use to increase lean body mass (LBM). Furthermore, steroids enhance recovery. The fact is, steroids allow some bodybuilders to work harder and more frequently for greater physiological overload. However, results are only yielded if an intense training regimen is occurring. Steroids cannot make a pit bull out a poodle. The most important thing to remember is that great long-term results come from training hard and smart, not from which drug you take. Though it may take you longer to achieve optimal results without the assistance of steroids, the natural results you do attain will be more rewarding, and you will not need to worry about the drug's dangerous side effects.

Selective Androgen Receptor Modulators (SARMs)

Selective Androgen Receptor Modulators: They are intended to have the same kind of effects as androgenic drugs like anabolic steroids do but to be much more selective in their action,[1] allowing them to be used for many more clinical indications than the relatively limited legitimate uses that anabolic steroids are currently approved for.

AAS are effective because they stimulate androgenic receptor sites, and this in turn opens the gateway to the anabolic process.

The issue is the unwanted side effects that can potentially accompany AAS abuse. Things such as hair loss are on the less severe end of the spectrum; on the other end are items such as enlargement of the heart, not to mention a potentially catastrophic disruption of hormonal homeostasis.

Unfortunately, when copious amounts of steroids are abused, a potential for unwanted thickening of the left ventricle and enlargement of the heart arises. Steroids do not limit growth to strictly skeletal muscle. When abused, cardiac muscle can grow big and inefficient, which is not the way a healthy heart grows from exercise.

From a cosmetic and performance-enhancement viewpoint, the development of SARMs not only lessens negative side effects of AAS but is convenient to the user who wants to avoid costly, weekly trips to the "Low T" clinic.

Testosterone is the steroid that all others are compared to. "Test" has an anabolic to androgenic ratio of 1:1.

Steroids that are called more androgenic, like Halotestin, greatly exceed this ratio in favor of being more androgenic. More mild compounds, such as Anavar, have a higher ratio of anabolic properties.

Peer-reviewed literature suggests SARMs have a ratio in favor of

anabolism ranging from 3:1 to 10:1. Synthetic testosterone can convert to estrogen, which causes excessive water retention and effects such as gynecomastia (swelling of breast tissue in men or boys). It's clear this is not something any male wants.

What exactly are SARMs?

SARMs were first developed in 1998. SARMs are developed for the same medical reasons as AAS are and to treat the same conditions, with the goal of having fewer side effects.

Even though they have been around for well over a decade, they remain in their beginning stages. SARMs work, as stated earlier, by binding to the androgen receptor (AR), as steroids do.

The primary role of the androgen receptor is in the development of bone, skeletal muscle, and sexual organs. What happens then when SARMs bind to the receptor?

They cause muscle and bone growth. This is why they are manufactured to treat osteopenia, osteoporosis, and muscle-wasting conditions like AIDS. SARMs' effect on growth is said to be localized to bone and skeletal muscle.

Manufacturers of SARMs, and some users, claim that the effectiveness of SARMs is comparable to high dosages of testosterone in regard to gains experienced by users in muscle size, strength, and the reduction of body fat. Of course, manufacturers are quick to preach that this all comes without the negative side effects caused by testosterone.

The question remains: Do SARMs inhibit your body's ability to produce testosterone naturally?

Synthetic testosterone, even in small amounts, causes a huge disruption of hormonal homeostasis. Even AAS used in minuscule amounts shut down your body's ability to produce testosterone. After all, why work hard to produce your own hormones when synthetic versions are readily available?

SARMs, according to some users, cause minimal disturbances to the endocrine system; others claim none. Scientifically, even with a 10:1 anabolic to androgenic ratio, some disturbance would be caused to your body's hormonal balance but probably not to the degree that a heavy steroid cycle would.

In high dosages, SARMs will most likely cause masculinizing side effects. Side effects for women using steroids are many times irreversible; SARMs will likely decrease the side effects that have been reported by women users. SARMs are taken orally, and at this time, they appear to be safe for the liver.

Some steroid-using bodybuilders report successfully using SARMs between steroid cycles as a "bridge" while administering a post cycle therapy (PCT) cycle of Clomid and HCG. The idea is that they are somewhat able to return to "normal" hormonally yet keep the gains made with anabolic steroids.

Some in the muscle building community have gone as far as to say that, in the world of anabolic drugs, SARMs are the biggest breakthrough since Dr. Ziegler developed Dianabol in the 1950s.

Though SARMs may sound like the perfect alternative to steroids, be warned. They are not a controlled substance in the United States.

Initially, this may sound like a good thing, but it is not. SARMs can be bought legally on the Internet in the United States, sold through a loophole, as they are sold as "research chemicals not for human consumption." This means that no regulatory body regulates the quasi chemists who manufacture SARMs. You simply have no way of knowing—with 100% accuracy and

confirmation—what is in them. The FDA keeps a close watch on pharmaceutical companies, but no one is monitoring "research chemical" manufacturers. That should be information enough for you to stay far away from SARMs.

Human Growth Hormone: Also known as somatotropin, is a peptide hormone that stimulates growth, cell reproduction, and cell regeneration in humans and other animals.

Human Growth Hormone (HGH)

Growth hormone has been used by athletes since the 1970s. In the late 1980s through the present, it has greatly increased in popularity. Depending on whom you consult, some report this as a wonder drug that greatly enhanced performance, whereas others tout it as completely ineffective in performance enhancement. Therefore, HGH is unlike steroids, where nearly every user experienced increased performance.

How did HGH become so popular?

The year 2004 was the first time Olympic athletes could be tested for HGH, but even current tests are believed by many experts to be ineffective. In fact, one of the reasons that HGH became so popular was because it was undetectable.

How Growth Hormone Works

Growth hormone stimulates cell reproduction and regeneration. Growth hormone is a protein-based peptide hormone that is secreted from the anterior pituitary gland.

Medically, HGH is prescribed to children to treat growth disorders. More recently, a growing number of life-extension clinics have used HGH to combat obesity and aging.

HGH has been shown to decrease body fat and increase lean body mass (LBM). Additionally, HGH increases bone density, immune function, sexual performance, and skin tone.

Modern pro bodybuilders are much larger than their classical counterparts. This metamorphosis started to take place once growth hormone arrived on the scene.

Interestingly enough, their limit-strength levels seemed, at best, to have been on par with those of bodybuilders 30–40 years ago and many times much less the strength levels of their predecessors. Arnold deadlifted 700 pounds and bench-pressed over 450 pounds, both raw (i.e., no powerlifting suit, lifting aids). Very few pros today could duplicate this, regardless of hype and claims that many bodybuilding fans take as gospel.

Many side effects might result from HGH abuse. The risks of side effects

become greater the more it is used and when not done so directly under a doctor's supervision. Many pro bodybuilders today use an excess of 12 IUs a day. A medical dosage, as part of an effective HRT protocol, is generally less than 2 IUs.

Side effects include carpal tunnel syndrome, premature death, irreversible heart enlargement, low blood sugar, excessive growth of body hair, edema, thyroid damage, liver damage, and permanent changes in facial structure. Aside from its possible side effects, HGH is extremely expensive. Even a moderate dosage can cost a user in excess of $1,000 a month.

Some believe using HGH causes muscle hyperplasia to take place (this means the growth of new cells and their development into muscle fibers). Prior to the late 1980s, Mr. Olympia, the top prize in bodybuilding, was won by individuals less than 230 pounds. However, since the mid-1990s, Mr. Olympia winners have ranged from 260–295 pounds (their contest, "onstage weight"). Many believe such an increase in the size and weight of today's contestants is because of growth hormone.

It can also be hypothesized that the enormous growth in the waistlines of drug-using professionals is because of the enlargement of internal organs caused from excessive use of growth hormone. Case in point: ever see contest photos of competitors who look as though they have large extended bellies yet are ripped with highly defined abs, obliques, and intercostals?

Many people believe that today's bodybuilding behemoths are more powerful than are those from years ago. *It's time for a wake-up call.* Appearance-wise, because champion bodybuilders are bigger and have more muscle than bodybuilders of previous eras had, one could logically assume these champions are stronger. After all, aside from neuromuscular factors, cross-sectional muscle area is another factor determining strength. This has not been the case. Bodybuilders today are much weaker, for the most part, than their classical counterparts.

Even if you decide to use drugs, as a bodybuilder, being weak is not what you want. Even the strongest bodybuilders today are not as strong as you would think, considering the amount of muscle mass they carry. The great classical physiques, like Arnold and Doug Young, were built without growth hormone.

Then why aren't many of today's bodybuilders as strong as those iron athletes of the past were? Could it come down to hyperplasia? Though today's behemoths have a great number of new muscle fibers, those new fibers aren't fully and optimally functional. If hyperplasia did take place, these new muscle fibers were spawned from a synthetic hormone. Thus, it does not guarantee they will be functional. New muscle fibers that are unusable may effectively cause neuromuscular retardation.

In the 1980s, Fred Hatfield wrote in *Powerlifting USA* about the ineffectiveness of growth hormone to produce gains in limit strength because muscle growth was limited to non-contractile elements of muscle. Anecdotally, users of growth hormone do not report massive increases in strength, and my observations confirm this. For bodybuilders, strength is critical.

Increased neuromuscular recruitment patterns and an increase in the area cross-sectional muscle fibers are the factors that increase strength. HGH does only one of these and may adversely affect neuromuscular recruitment patterns. Even if you decide to load up with every drug under the sun, you may not become stronger! The biggest bodybuilder of all time, Ronnie Coleman, is also the strongest. Even since Ronnie's retirement, no one has come close to matching his level of dominance in the sport or duplicating his physique. The effects of drugs may be temporary, but years of hard work in the gym last a long, long time.

IGF-1

IGF-1: A primary mediator of the effects of growth hormone (GH). Growth hormone is made in the anterior pituitary gland, is released into the bloodstream, and then stimulates the liver to produce IGF-1.

Insulin-like growth factor-1 (IGF-1) is a polypeptide hormone composed of 70 different amino acids. IGF-1, like insulin, growth hormone, and testosterone, has great muscle-building properties. IGF-1 is released in the liver, and just like increased protein synthesis and nitrogen retention, IGF-1 is in part responsible for the anabolic activity of growth hormone. Some believe that IGF-1 can be used in place of HGH and be just as effective.

Lifters seeking to add mass use IGF-1because it is anti-catabolic. Like HGH or AAS, it is also most effectively used with a high-protein diet because of the increased protein synthesis.

Although synthetic IGF-1 use can increase muscle mass and aid in fat loss, there is no direct evidence that IGF-1 aids in strength gains, even minimally. Athletes have been willing to try it outside of bodybuilding because it is not detectable by drug testing. Possible side effects for the non-medical use of IGF-1 are swelling of the hands, Bell's palsy, heart palpitations, and risk of entering into a diabetic coma.

Users who report huge gains in mass with IGF-1 always stack it with numerous other anabolic agents. Although we know the risk of side effects is extremely high with IGF-1, it is tough to confirm the level of anabolism it can help spark.

Insulin

Insulin: A hormone produced in the pancreas by the islets of Langerhans that regulates the amount of glucose in the blood.

Synthetic Thyroid Hormones: t4 and t3.

Insulin is a peptide hormone that controls the levels of glucose in the body, and it is secreted from the pancreas. In the synthetic form, it has legitimate medical usages for people with diabetes.

Why would a strength athlete or bodybuilder use insulin?

For one, insulin is very anabolic and helps move glucose into muscle cells. Additionally, it increases protein synthesis and regulates sugar metabolism. Insulin supports anabolism by super saturating the cells with nutrients and simultaneously increasing cell volume. Users report size increases but oftentimes coupled with excessive bloat or body fat.

Some top-level powerlifters have used synthetic insulin, but most were disappointed with the results. Reports from the former Soviet Union talk about athletes using insulin, but again, this was stacked with a number of other drugs, so its effectiveness on strength and performance are still to be determined.

Insulin is very anabolic but can promote extreme gains in body fat; insulin might be in large part responsible for the protruding waistlines

that haunt many of today's chemically enhanced bodybuilders.

When it comes to using drugs, each one offers a risk-to-benefit ratio.

Insulin falls into the extremely risky category.

Unlike with steroids or growth hormone, insulin's greatest risk is an overdose, and this can result in immediate death.

FAT-LOSS DRUGS

Clenbuterol is a popular drug for those wishing to shed body fat, and it is a staple in the cutting regimen of chemically enhanced bodybuilders.

Clenbuterol is effective because of its ability as a beta-2 agonist. Clenbuterol stimulates the beta-2 receptors and allows the body to burn and release stored fat.

Clenbuterol also helps athletes preserve muscle mass when in caloric deficits. Clenbuterol's clinical use for humans is as an asthma drug. It is approved for use in many countries, but it is a controlled and banned substance and is *illegal* to possess in the United States.

It should be noted that Clenbuterol potentially has some extremely serious side effects such as enlarged heart, increased blood pressure, increased body temperature, and heart palpitations. It is not a good idea for anyone to use Clenbuterol, but it is especially ill advised for those with high blood pressure.

Ephedrine

Ephedrine has come under scrutiny because a few athletes have died from its use. Because of this negative attention, the federal government banned ephedrine. That ban has since been overturned, yet some states and athletic bodies still outlaw the sale of ephedrine. Most supplement companies are afraid to manufacture ephedrine because of potential lawsuits and bad press.

Why would an athlete use ephedrine? Ephedrine can be quite effective for fat loss, as it helps suppress appetite and enhances the sympathetic nervous system, but it can cause some athletes to feel more aggressive.

In many, ephedrine is an effective fat burner. But like any other ergogenic substance, it can have side effects, the most serious of which is a faster or irregular heartbeat.

Synthetic Thyroid Stimulants

Other **synthetic thyroid hormones** such as Cytomel (T3) and T4 are commonly used by bodybuilders during the final cutting phases. Unfortunately, these drugs have found their way into other sporting events by athletes wanting to cut fat.

For some, Cytomel and T4 can be effective. However, by using these compounds for a long duration, the user can put his or her thyroid into a negative feedback loop of using the synthetic version, which inhibits natural production.

Other potential side effects of these drugs include high blood pressure, heart failure, rapid heartbeat, irregular heartbeat, increased appetite accompanied by weight loss, fever, anxiety, irritability, insomnia, emotional changes, muscle weakness, painful breathing, diarrhea, hair loss, and seizures.

Although these side effects are rare, throwing the body out of homeostasis should serve as serious motivation to avoid these synthetic thyroid hormones.

Synthol

Synthol, thankfully, has fallen out of style in the last couple of decades, but some bodybuilders still insist on using this bizarre enhancement.

Think of filling up a water balloon. Synthol works in a similar way, but the balloon is the muscle you are injecting the synthol into, and the water is the synthol oil. Synthol does nothing to actually strengthen or build the muscle; it just accumulates within the muscle. Not all muscles can be injected with synthol. That's why you see guys with way-out-of-proportion arms and shoulders. Synthol injections literally caused Gregg Valentino's arms to explode due to infection.

The conclusion of the *Journal of Medical Case Reports* was that, besides the risk of infection, synthol injections used for short-term enhancement of muscle risks long-term, painful muscle fibrosis and disfigurement.

Esiclene

Like synthol, esiclene is used to cause very temporary localized muscle growth. Originally, this compound was used to treat children with growth deficiencies. Unlike synthol, esiclene is a steroid. Bodybuilders inject this into a muscle, which will cause an inflammatory response that increases muscle size at the site of injection. Esiclene has a very short half-life; after one day, the swelling will start to reduce, and the muscles go back to their original form within four days. Esiclene is commonly used on small muscle groups.

Stimulants

Stimulants have been around for quite some time. For thousands of years, native culture has ingested certain herbs or plants to stimulate the central nervous system (CNS).

Ephedrine was first synthesized in 1887 in Germany. After amphetamines had gained popularity in the United States, the government in the 1960s deemed these drugs a controlled substance. Many users then switched to cocaine.

Taking harsh, illegal stimulants such as cocaine and amphetamines has the general effects to the peripheral nervous system (PNS) of vasoconstriction (increased blood pressure) and tachycardia.

The central nervous system (CNS) is affected by increased motor activity, inducing increased alertness and agitation, and some users reported heavy increases of aggression while under the influence of the aforementioned agents.

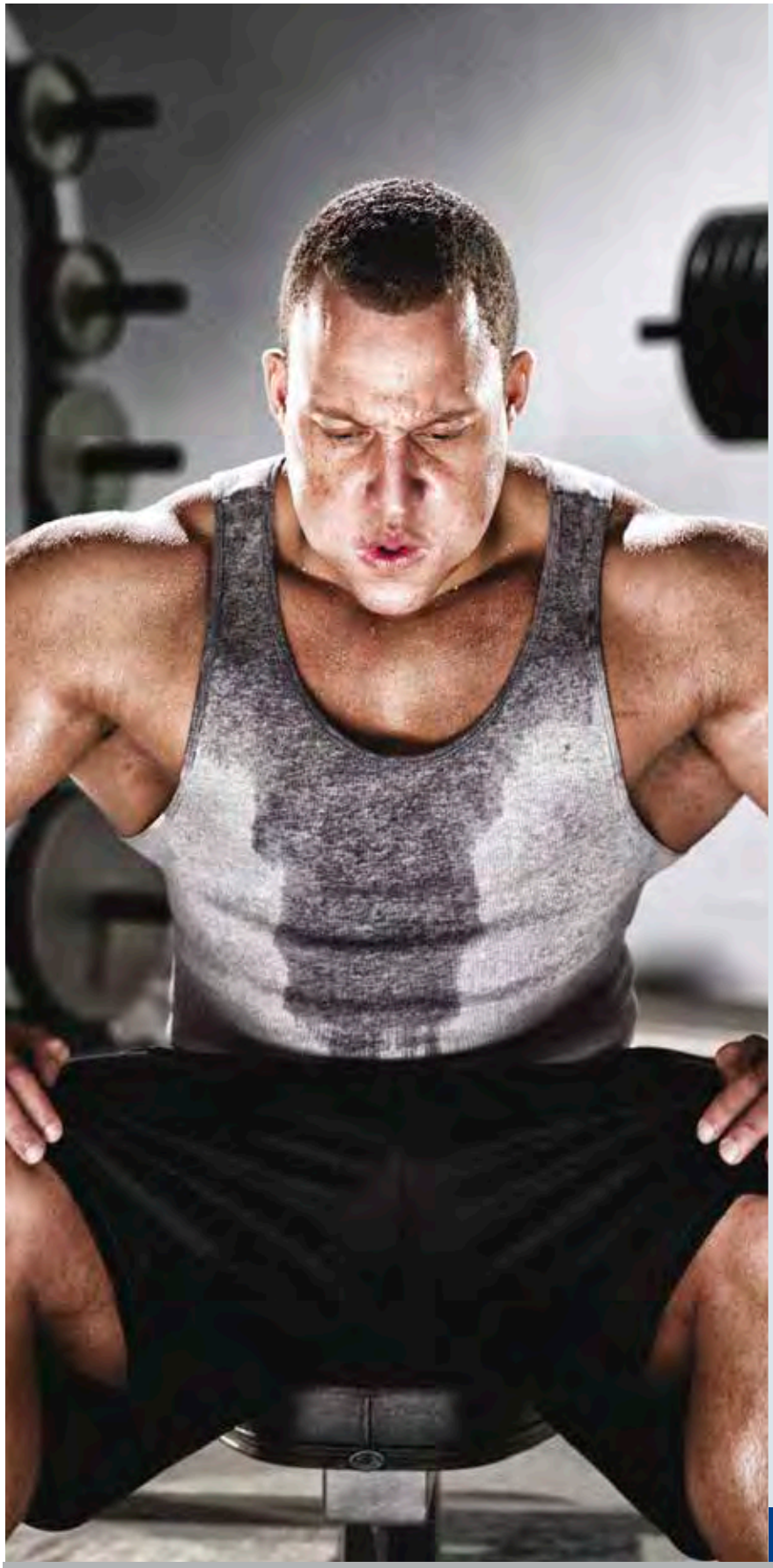
It should be noted, however, that many users anecdotally report that with low dosages of amphetamines (science backs these claims), these drugs open up their airway and provide a feeling of euphoria, wakefulness, and decreased fatigue. These are very low dosages and probably not used with aggressive personalities to begin with.

Some of the psychological effects may seem favorable to you, but when they are weighed against the negative physiological side effects, it is easy to see that they are not favorable at all. Now add to all of this the withdrawal effects that can lead to anything from excessive weight gain to an increased likelihood of suicide.

A FEW LAST WORDS

Remember, you can be strong and build a great physique without ever taking drugs. Drug-free athletes used a majority of this book's programs successfully. To be strong and build a great physique, careful attention will need to be paid to program design and training with a smart, aggressive mentality. Mel Siff said it best in *Supertraining:* "The widespread use of steroids and other chemical supplements is frequently an admission that one has run out of training ideas to produce further progress naturally."

Our philosophy is this: Doing it naturally might take longer, but the result will be healthier, longer lasting, and satisfactory!



TOPICS COVERED IN THIS UNIT

Individual Differences

Stressors

High-Frequency Fatigue (Electromechanical Fatigue)

Low-Frequency Fatigue (Mechanico-Metabolic Fatigue)

Long-Term Fatigue

Nutrition and Supplementation

- Performance-Enhancing Drugs (PEDs)

Deloads for Bodybuilding

- Active Recovery
- Weider System
- Recovery
  The Planning Factor
- Bodybuilding Deload
  Take-Home Points

Sleeping

Further Expediting Recovery

- Chiropractic Care
- Massage
- Foam Rolling
- Contrast Baths
- Epsom Salt Baths
- Electromyostimulation (EMS)
- Cryotherapy (Ice Massage)
- Cryokinetics for Low Back and Leg Recuperation

A Few Last Words

UNIT 14

RECOVERY

All athletes, particularly bodybuilders, benefit from a properly planned recovery period. Far too many of them are not recovering properly, leaving them with less-than-optimal gains in size and strength.

A few questions heard time and time again include "When is muscle developed?" "Do we get stronger during heavy deadlifts?" and "Do muscles get bigger with endless heavy bench presses?"

Without proper recovery being employed, the answer to all three is no!

Recovery is the period when our muscles grow and become stronger. The muscle actually begins breaking down during training and is in a catabolic state. Once recovery begins, the body flips the switch, so to speak, and muscle is then in the preferred anabolic state.

Intense weight training forces the muscle fiber to adapt to the intense strain placed on it, break down, and prepare for muscle hypertrophy once recovery begins and the anabolic window opens.

Bodybuilders taking a holistic approach to maximize development use multiple exercises, tempos, rep schemes, and intensity levels. Because bodybuilders stress many muscle fibers at different levels of intensity, optimizing recovery is like gospel. The object is not to adapt to training, as in so many other sports; it's to prevent this from happening so you can keep breaking down muscle fibers and continue making them grow.

INDIVIDUAL DIFFERENCES

It is not surprising that recovery rates will vary among bodybuilders. Bill Pearl and Arnold Schwarzenegger often prescribed hitting muscle groups every other day. Ronnie Coleman trained muscle groups twice a week. Branch Warren trains muscle groups only once a week.

Why is there such a variety of recovery periods for athletes in the same sport?

Recovery is mostly determined by the athlete's genetic blueprint. Ectomorphs typically have the hardest time gaining muscle mass, mesomorphs gain muscle mass the most easily, and endomorphs typically gain fat more rapidly than muscle.

A number of other factors can determine adequate recovery periods. One factor is intensity. Doing 25 sets per body part, taking a majority of sets to momentary muscular failure, is harder to recover from than is doing 10 sets in a workout with reps to spare at the end of each.

STRESSORS

Overtraining is not just training too intensely too often; it is an accumulation of all of life's events. Every day in our lives we are bombarded with a variety of stressors. Frequently, these stressors are of low enough "intensity" or subtle enough that they don't affect us.

What's worse, of those stressors that do have a more immediate negative effect, their intensity is often compounded by the mere presence of the many other stressors.

For example, any number of environmental stressors can have physical or physiological consequences. And one's psychological state is inextricably intertwined with one's biochemistry.

Table 14.1 lists common stressors that can directly influence overreaching and overtraining.

As a rule of thumb, you want to eliminate (or, if you can't eliminate it, minimize the ill effects of) all stressors except the very last five. These, you want, but only if you can control them.

Table 14.1: Common Stressors

Environmental	Psychological/ sociological	Physiological/ biochemical	Anatomical/ structural
• Excessive heat or cold • Excessively high or low humidity • Excessive altitude (above or below sea level) • Challenging terrain • Ultraviolet irradiation • Environmental pollution • Poorly designed clothing • Poorly designed equipment • Airborne pollen and other allergens • Poor training facilities	• Job problems • Depression • Mental illness • Neurological disorders • Pain • Aging • Anger • Fear or anxiety • Problems with academic studies • Shaky financial status • Family problems • Sexual problems • Personality conflicts • Schedule conflicts • Boredom • Lack of encouragement • Psyching up too frequently • Pressure to perform • Lack of adequate coaching	• Environmental stress • Psychological stress • Anatomical/structural stress • Aging • Disease • Myriad genetic factors • Sleep disorders • Poor nutritional status • The use, misuse, or abuse of prescription or recreational drugs • The use, misuse, or abuse of herbs (phytochemicals) and nutritional supplements	• Surgically altered tissue structure • Injury-induced alterations in tissue structure • Environmental stress • Physical defects • Poor genetics • Aging • Overuse stress • Poor exercise technique • Ill-conceived training program • Exertional stress (especially eccentric muscle actions) • Too much training volume • Too much training intensity • Too much training duration • Too much training frequency

Many mechanisms are believed to be responsible for fatigue (long term and short term). By cursorily reviewing the mechanisms of short-term fatigue, we can gain a more complete perspective of the dynamics of long-term fatigue—burnout.

You will see that short-term fatigue can involve any or all of the various mechanisms involved in movement, from the thought process to the final contraction of the muscle.

Back in 1978, exercise scientists in England divided short-term fatigue into two groups: central fatigue and peripheral fatigue. The causes of central fatigue include diminished motivation, impaired transmission of nerve impulses down the spinal cord, and impaired recruitment of motor neurons.

In a 2007 article in Experimental Psychology, Ross et al. explained that

Stressors: A stressor is anything that causes the release of stress hormones

Environmental Stressors: These are stressors that put strain on our body (injury, illness, hot/cold temperatures).

Psychological Stressors: Events, situations, individuals, or anything we see as threatening or negative.

central fatigue in the brain still activates the muscles, but the muscles are a "potent competitor."

The causes of peripheral fatigue, however, involve impaired function of the peripheral nerves serving the individual muscles, impaired transmission of electrical impulse at the neuromuscular junction, and impaired processes of stimulation within the muscle cell (including metabolite changes resulting in depletion of ATP and thereby the function of the contractile machinery of the cell).

Those same British scientists subdivided peripheral fatigue into two groups: high-frequency fatigue and low-frequency fatigue.

High-Frequency Fatigue: Also known as electromechanical failure, this is characterized by an excessive loss of force at high frequencies of stimulation and rapid recovery when the frequency is reduced.

HIGH-FREQUENCY FATIGUE (ELECTROMECHANICAL FATIGUE)

In sports in which you sustain rapid movement patterns for more 60 seconds, force output losses typically result from failure of action potentials (the ability of the membrane to conduct electrical impulses) along the surface membrane (sarcolemma) of the muscle cell. It's the sarcolemma that transmits electrical impulses into the tiny openings on the muscle cell's surface (called t-tubules), and on to the individual actin/myosin filaments. The failure of the action potentials is believed to be due to a buildup of potassium both inside the t-tubules and between the actin/myosin filaments. It is not believed to be a result of lactic acid buildup or too little oxygen.

High-frequency fatigue (electromechanical failure) typically occurs most readily in "cold" muscles, although maximal and repetitive movement of more than about 60 seconds' duration is also believed to cause such nervous system fatigue. It probably has little bearing on short- or long-term fatigue of the type seen among bodybuilders.

Low-Frequency Fatigue: In this type of fatigue, low-frequency force output is limited despite adequate electrical stimulation.

LOW-FREQUENCY FATIGUE (MECHANICO-METABOLIC FATIGUE)

Now we're getting somewhere!

In this type of fatigue, low-frequency force output is limited despite adequate electrical stimulation. Everyone knows that it's the buildup of lactic acid that causes this sort of fatigue, correct?

Not so fast!

In 1981, Ciba Corporation's foundation funded research demonstrating that short-term fatigue can be experimentally induced among individuals with metabolic defects that influence energy pathways and lactic acid accumulation.

Then what is the most important mechanism causing fatigue?

Cellular damage.

Whoa!

This indeed conjures up all types of wondrous theories.

Here's where it all becomes interesting from the standpoint of how short-term fatigue (of the low-frequency variety) is the principal cause of long-term fatigue, or "burnout."

It's quite simple really.

It is believed that low-frequency fatigue (especially involving eccentric contraction as opposed to concentric contraction) results from the tearing and rending of those very cellular structures that carry the electromechanical impulses, to such a degree that (not unlike a torn or frayed electrical wire) the electrical impulses are considerably weakened. A drastic decrease in force output is exacerbated following eccentric contraction.

LONG-TERM FATIGUE

Here we arrive at the "burnout" stage. Here's what happens.

First, the microtrauma resulting from eccentric contraction (and to a lesser degree with concentric contraction) begins to accumulate because you are not taking proper restorative measures between workouts, or you are engaging too heavily in eccentric work, or both. The "cumulative microtrauma," being disruptive of the electromechanical impulses that "drive" the contraction process, never gets to the actin and myosin in sufficient intensity (twitches per second) to generate maximum force.

This is what the British scientists refer to as the "Catastrophe theory" of fatigue. British scientists Drs. Gibson and Edwards explained that, in aerobic exercise, the marginally deficient rate of ATP supply resulting from such electrochemical deficiency may indeed go unexplained. This being the case, cumulative microtrauma is never tended to, and restoration is never complete, a situation that may indeed result in an overtrained state over weeks (or even months) of time.

But among anaerobic athletes (bodybuilders), it's a bit different. Gibson and Edwards continue to explain that, after an isometric contraction, for instance, the recovery of both ATP and excitatory capabilities of the muscles is rapidly restored. If high-frequency fatigue is stimulated, again recovery is instantaneous (ruling out metabolic fatigue and supporting the lowered excitation explanation).

According to Gibson and Edwards, what's left as the most reasonable explanation for fatigue is the catastrophe theory. But they never really examined the long-term effects of continually eliciting countless miniscule "catastrophes" inside the muscles, day after day, workout after workout, for months on end. Let's do that now.

There are two ways to cope with cumulative microtrauma: You can avoid it, or you can treat it.

You avoid it *not* by avoiding lifting or by avoiding a small amount of (normal) cellular destruction, but rather by not letting microtrauma accumulate.

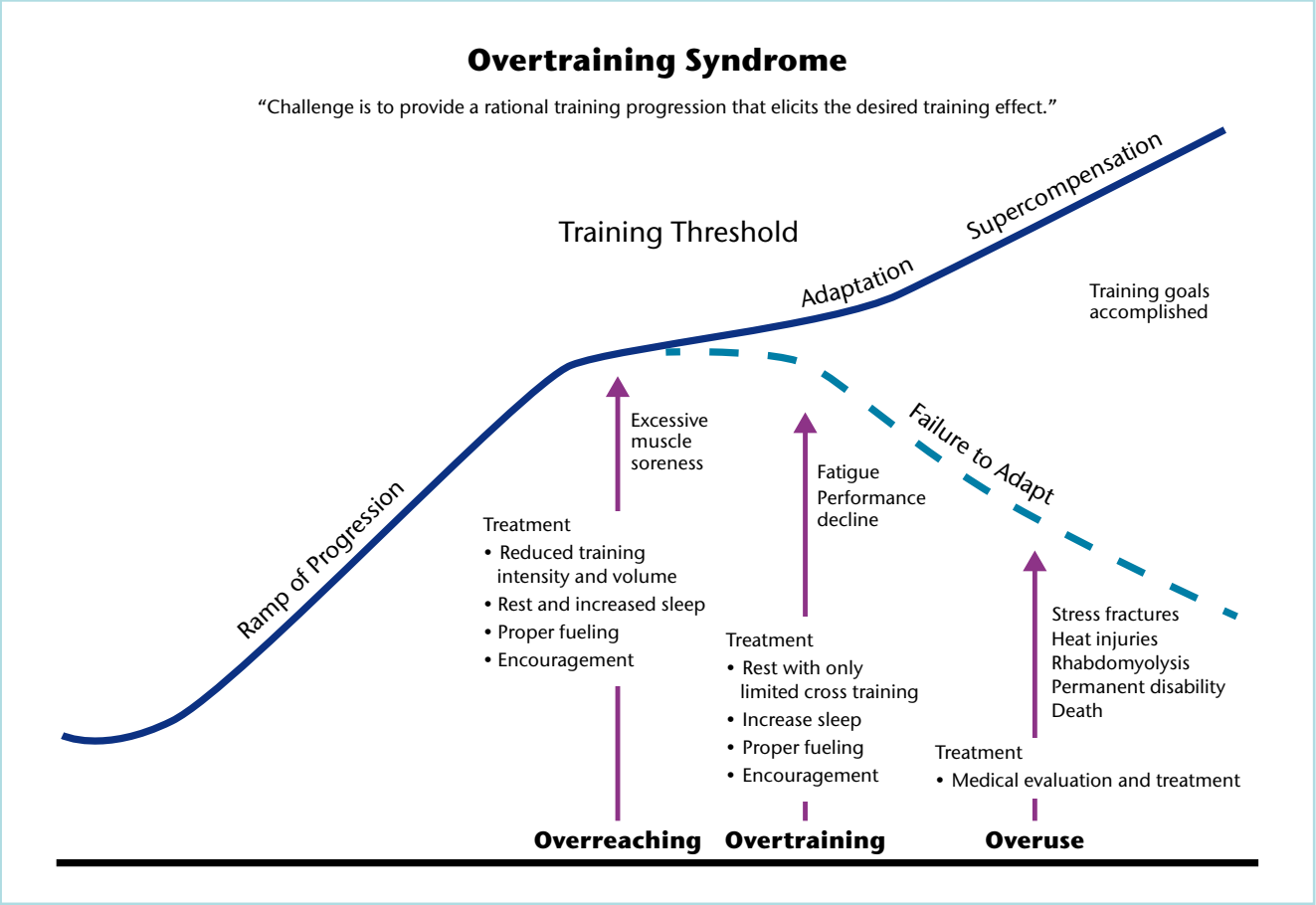


Figure 14.1 Burnout and overtraining.

You do this the same way you treat cumulative microtrauma, via the following:

- Sensible, scientific weight training and light resistance systems of training, which employ a carefully devised "periodicity" or "cycle" method
- Sensible, scientific application of the many therapeutic modalities at your disposal that will be described throughout this unit
- Sensible, scientific nutritional practice (especially maintaining an adequate amino acid pool to affect protein turnover, adequate energy foods to replace those depleted during intense training, and a minimum of 5 meals daily)
- Sensible, scientific nutritional supplementation (especially the branched-chain aminos, adequate protein, vitamin and mineral intake, and other state-of-the-art supplements designed to aid tissue recovery and healing)
- Proper technique in your lifting and skills (especially avoiding excessive eccentric contractions ["negatives"] and uncontrolled ballistic movements)
- Plenty of rest both between workouts and at night (trying to get at least 9 hours per night, plus at least 1–2 short 20-minute "cat naps" during the day)
- The use of various psychological techniques that promote restoration (especially meditation, visualization training, hypnotherapy, or self-hypnosis techniques)

Thus, it all boils down to a simple plan: do things the best way science offers. The previous list ought to at least get you thinking along some reasonable pathway in that regard.

NUTRITION AND SUPPLEMENTATION

Following a sound dietary plan is the easiest way to promote optimal recovery. In fact, it is impossible to recover from intense exercise without following a sensible nutrition and supplementation plan. Continue to review the information presented in Units 12 and 13 pertaining to optimal caloric intake, intra workout nutrition, post-workout nutrition, and supplementation. Additionally, take notes of the dietary strategies that promote optimal recovery in you and your clients. The best dietary strategy for one individual is not necessarily the best dietary strategy for someone else.

PERFORMANCE-ENHANCING DRUGS (PEDS)

Another factor to consider is the use of PEDs (see Unit 13).

Testosterone, an androgenic hormone the body produces, is paramount in creating an anabolic environment for muscle. If athletes choose to introduce PEDs to their training regimen, the workload on the muscle can be increased as the recovery period is accelerated. It is important to remember, regardless of muscle-building drugs cycled into your regimen, that PEDs accelerate muscle recovery; they do not enhance the recovery of your central nervous system.

In his book *Science and Practice of Strength Training,* Vladimir Zatsiorsky espouses that training a core movement above 90% of one's one-repetition maximum with the maximal effort method for more than three weeks in a row will cease and even reverse progress.

This is why after three weeks with 90% plus, it is important to switch core movements or take a week of less intensity, less than 70%. This happens because of central fatigue and inability to perform due to factors of the central nervous system. Peripheral fatigue/muscular-related fatigue can be somewhat counteracted with PEDs, whereas central fatigue cannot. Regardless of drug status, carefully monitor volume at 90% of core lift maxes.

DELOADS FOR BODYBUILDING

Deload: A purposeful reduction in training volume & intensity for the purposes of recovery, injury prevention, and improved performance.

Powerlifters typically train movements with little purposeful isolation of muscle groups. The individual lifts typically involve multiple muscle groups. Typically, the core exercises are only done once a week,

sometimes twice. Some popular Eastern European programs, however, suggest performing each lift multiple times per week, but very submaximal weights are used, and assistance movements are very limited.

Many powerlifters use a "deload week." I have trained many world-record-setting powerlifters and have implemented some form of deloading with all of them. The deload is an excellent tool to rest connective tissue and muscles, and most importantly, the central nervous system (CNS).

A simple guideline to follow for deloading is less than 70% intensity (lighter weights used) and less than 70% volume (sets and reps) of what is used during a standard training session. It is not uncommon for powerlifters to take anywhere from seven to fourteen days off prior to a meet so that they are fully recovered prior to a maximum-effort lift.

It is also common for powerlifters, following the meet, to take the week off from training to rest the CNS after a maximum effort. After all, many Russian researchers have concluded maximal competition lifts can take weeks to recover from because of the tremendous stress on the CNS.

As a bodybuilder, you must train core movements as well as isolated muscle groups. Bodybuilders can typically follow a deload recovery protocol similar to that of powerlifters.

Deloads for powerlifters provide a chance to perform lifts in compensatory accelerated style with submaximal weights, along with the opportunity to refine technique.

Bodybuilders, of course, need great technique, but the object is much more sophisticated than simply moving the weight from point A to point B. The object is muscle hypertrophy of the specific muscle groups being used. If your anterior delts are very powerful, they may overpower your pecs on the bench press. This may call for a pre-exhaustion protocol or even eliminating the movement from your arsenal during a deload period.

It is important to pay attention to kinesthesia and the physical changes taking place. I highly suggest opening a Photobucket account (they are free) so you can make honest assessments of aesthetic progress of both your clients and yourself. Regardless of what the tape or scale says, the illusion on stage will be the only assessment that matters.

Deload weeks are lighter; this is the same concept Fred Hatfield, a.k.a. "Dr. Squat," used in his ABC system of bodybuilding covered in the Unit 9. The A day is a *deload,* also referred to as a *light day.*

Deload workouts give bodybuilders a chance to perfect movements because intensity is not a concern. These workouts are not blow-off workouts; they are technique workouts. Follow periods of high intensity with periods of low intensity using the provided guidelines, and you will look, perform, and feel better.

Some folks may feel that deloads are not for them. Should the skinny person just trying to add a little muscle deload? Of course! As stated earlier, without adequate recovery, the muscle cannot grow or become stronger. Recovery opens the anabolic window.

How about the person who is leaning out? Is recovery important to him or her?

Yes!

When dieting, the body is automatically in a catabolic state. That means that fat *and* muscle are decreasing. The idea is to save as much muscle as possible. Adequate recovery is a must.

By systematically programing deload weeks into your training regimen, there will be fewer "off days" resulting from feelings of being broken

down. In turn, the potential for optimal muscle growth increases, as you won't have to abruptly stop training when your body feels broken down.

BODYBUILDING DELOAD TAKE-HOME POINTS

- Volume (sets × reps × weight): Perform 60%–70% of total workload
- Perform reps in a peak contraction style
- Work on perfecting movement technique

Deload every 3–6 weeks. (This is a guideline, not the rule.)

Here is a practical example of a chest workout for a bodybuilding deload. Workout A is the last intense chest workout; workout B is the deload version.

Workout A (Intense Workout)	
Band Resisted Incline Dumbbell Incline Presses	4 sets x 8 reps (band resistance 25% of total dumbbell weight)
Weighted Dips (Forward Lean)	12, 12, 8, Rest Pause (3 total sets @ 80% of one-rep max)
Negative Overload Smith Machine Bench Presses	(5-second negative); once this pace can no longer be achieved, do as many reps as possible without negative overload weight x 3 sets
Chain Flyes	12 reps/Dumbbell Pull Over—20 reps (3 super sets)
Time under Tension Incline Cable Flyes	(40 seconds) x 3 sets

Workout B (Deload Workout)	
Incline Dumbbell Incline Presses	3 sets x 8 reps (same weight as last week, minus bands)
Dips (Forward Lean)	Body weight x 8 x 3 (really work on feeling the movement)
Smith Machine Bench Presses	(5-second negative) x 6 x 2 sets (use 70% of last week's weight)
Chain Flyes	12 reps/Dumbbell Pull Over—20 reps (2 super sets—use 70% of last week's weight)
Incline Cable Flyes	10 x 2 sets (use 70% of last week's weight)

Active Recovery: Exercising with gradually diminishing intensity immediately after a bout of vigorous exercise.

ACTIVE RECOVERY

Active recovery stems from the notion that you recover more efficiently when you are active. Numerous studies have demonstrated that elevated muscle blood flow through low-intensity exercise is highly beneficial: It helps minimize the delayed onset of muscle soreness (DOMS), and it enhances muscle healing.

Powerlifters are light years ahead of bodybuilders when it comes to active recovery. Sled dragging with a light weight performed the day following a heavy squat is a popular strategy for active recovery. Some powerlifters will drag a sled with extremely light weight for 10–20 minutes straight; others will do sled-drag trips of 20–60 yards with light weight and short rest intervals. Even a low intensity 15–20 minute walk can serve as a resourceful active recovery modality.

Active recovery after a heavy chest workout could vary from extremely light dumbbell bench presses to increase blood flow to a dynamic stretch or even foam rolling.

Light activity can enhance recovery; the key is not to add an additional stressor. The day following your bench-pressing 400 pounds for reps, doing dumbbell bench presses with 15 pounds can aid in your recovery, whereas doing 1,000 push-ups will not. Common sense must be applied to active recovery.

WEIDER SYSTEM

The Weider system was developed to guide you in developing your own personal system based on your own unique recuperative ability, experience, goals, strengths, weaknesses, and "guts" to go the distance. Initially, many in the lab chose to scoff at the Weider Principles, yet science has confirmed many of them.

The Weider System guidelines are a series of training methods collected (and in many instances named) by Joe Weider over many years. The guidelines became widely known as the Weider Principles.

In fact, of the Weider Principles that were developed by Joe personally, one in particular had a major influence on the world of bodybuilding. That was the concept of splitting your workouts to train specific body parts. The Split System, Double Split System, and Triple Split System, as

they became known, are Joe's unique contribution to bodybuilding science.

Joe was a true pioneer, the founder of modern bodybuilding, and he has done more for the sport than anyone has.

We cannot forget Joe Weider.

The Weider Principles encompass three broad categories:

1. Principles to help you plan your training cycle
2. Principles to help you arrange your exercises in each workout
3. Principles to help you perform each exercise

This is periodization in action.

It is easy to discern whether this orderly collection of training methods, both in the aggregate and individually, adheres to the seven Granddaddy laws outlined in the ISSA Certified Fitness Trainer course.

The truth is that individually, each does not. But when you look at the methods in the aggregate, and the guidelines as to when and how to apply them, then they most certainly do.

Here's why:

The fact that you are training at all assumes you know (a) you're going to grow (Overcompensation Principle), (b) you're going to train regularly (Use/Disuse Principle), and (c) weight training is the most efficient method of doing (a) and (b) as opposed to, say, riding a bicycle (Specificity Principle).

Both the type and amount of adaptive stress each of the Weider Principles delivers to the organism can be manipulated efficiently and effectively (SAID and Overload Principles, respectively).

Each method listed in the Weider System has its strengths and weaknesses in regard to the specific muscle components it targets (SAID Principle), so you must use your instinct and experience in determining when to apply each or whether to apply any at all (Individual Differences Principle); and the list of methods is completely flexible.

Within the instructions for each are listed guidelines to aid you in discerning whether to use the principle and how often to employ it in your day-to-day training microcycles (GAS and Individual Differences Principles).

RECOVERY THE PLANNING FACTOR

The three categories of principles discussed in the Weider System are listed in the next subsection with a brief explanation of each. One of the principles appears in all three categories. That's the Instinctive Training Principle.

When planning and carrying out a training program, use your own training experience and knowledge of how your body responds to exercise stress. This must occur on a cycle-to-cycle, day-to-day, and quite literally minute-to-minute basis!

This does not mean not having a plan; it means being able to adapt your plan. This is why it is important to keep a training journal. The more detailed the journal, the more effectively you will be able to prescribe training variables.

Principles for Planning Your Training Cycle

Cycle Training Principle: Breaking your training year into cycles for strength, mass, or contest preparation.

- **Cycle Training Principle** (By breaking your training year into cycles for strength, mass, or contest preparation, you help avoid injury and keep your body responsive to adaptation.)
- **Split System Training Principle** (Breaking your workout week into upper versus lower body training, for example, results in more intense training sessions)
- **Double or Triple Split Training Principle** (This entails breaking your workout down into two or three shorter, more intense training sessions per day.)

Muscle Confusion Training Principle: Constantly varying exercises, sets, reps, and weight to avoid accommodation.

Progressive Overload Training Principle: Gradually increasing the difficulty of workouts by increasing different variables.

Holistic Training Principle: Using a variety of rep/set schemes, intensity, and frequency to maximize muscle mass.

Eclectic Training Principle: Combining mass, strength, or isolation-refinement training techniques into your program as your instincts dictate.

- **Muscle Confusion Training Principle** (Muscles accommodate to a specific type of stress [“habituate” or “plateau”] when you continually apply the same stress to your muscles over time, so you must constantly vary exercises, sets, reps, and weight to avoid accommodation.)
- **Progressive Overload Training Principle** (The basis of increasing any parameter of fitness is to make your muscles work harder than they are accustomed to.)
- **Holistic Training Principle** (Different cellular organelles respond differently to different forms of stress, so using a variety of rep/set schemes, intensity, and frequency will maximize muscle mass.)
- **Eclectic Training Principle** (Combining mass, strength, or isolation-refinement training techniques into your program, as your instincts dictate, often helps you achieve greater progress.)
- **Instinctive Training Principle** (Eventually, all bodybuilders instinctively attain the ability to construct diets, routines, cycles, intensity levels, reps, and sets that work best for them. Of course, bodybuilders should still seek outside counsel. The more you as a bodybuilder advance, the more important it is to receive input and implement it in the training cycle. To make instinctive training work, you must be objective.)

Principles to Help You Arrange Your Workout

Set System Training Principle: Performing multiple sets for each exercise to apply maximum adaptive stress.

Superset Training Principle: Alternating opposing muscle group exercises with little rest between sets.

Compound Sets Training Principle: Alternating two exercises for one body part with little rest between sets.

- **Set System Training Principle** (Performing one set per body part was the old way; the Set System calls for multiple sets for each exercise to apply maximum adaptive stress.)
- **Superset Training Principle** (Entails alternating opposing muscle group exercises with little rest between sets.)
- **Compound Sets Training Principle** (Involves alternating two exercises for one body part with little rest between sets.)

- **Tri-Sets Training Principle** (Athlete does three exercises for one muscle group with little rest between sets.)
- **Giant Sets Training Principle** (Athlete performs 4–6 exercises for one muscle group with little rest between sets.)
- **Staggered Sets Training Principle** (This involves inserting 10 sets of boring forearm, abdominal, or calf work in between sets for, say, chest or legs)
- **Rest-Pause Training Principle** (Using 85%–90% of your max, do 2–3 reps and put the weight down, then do 2–3 more, rest, do 2–3 more, and rest for a total of 3–4 rest-pauses. The short rest-pauses allow enough time for ATP to be resynthesized and permit further reps with the heavy weight.)
- **Muscle Priority Training Principle** (Work your weaker body parts first in any given workout; alternatively, work the larger muscle groups first, while you're fresh and energy levels are still high.)
- **Pre-Exhaustion Training Principle** (This includes superset flies, a chest isolation exercise with bench presses, and a compound exercise involving triceps and chest to maximize chest development by pre-exhausting the triceps.)
- **Pyramiding Training Principle** (Start a body part session with higher rep/low weight and gradually add weight [and commensurably reduce the reps], ending with a weight that you can do for 5 reps or so.)
- **Descending Sets Training Principle** (Use lighter weights from set to set as fatigue sets in; called stripping.)
- **Instinctive Training Principle** (Eventually, all bodybuilders instinctively attain the ability to construct diets, routines, cycles, intensity levels, reps, and sets that work best.)

Principles to Help You Perform Each Exercise

- **Isolation Training Principle** (All muscles act as stabilizers, synergists, antagonist, or protagonist. By making any given muscle the prime mover in any given exercise, you've isolated it as much as possible, and therefore the stress applied to it)
- **Quality Training Principle** (Gradually reduce the rest between sets while still maintaining or increasing the number of reps performed)
- **Cheating Training Principle** (Swing weight past the sticking point at the end of a set to add stress.)

Tri-Sets Training Principle: Doing three exercises for one muscle group with little rest between sets.

Giant Sets Training Principle: Doing 4–6 exercises for one muscle group with little rest between sets.

Staggered Sets Training Principle: Injecting 10 sets of boring forearm, abdominal or calf work in between sets for, say, chest or legs.

Rest-Pause Training Principle: Using 85%–90% of your max, do 2–3 reps and put the weight down, then do 2–3 more, rest, do 2–3 more, and rest for a total of 3–4 rest-pauses.

Muscle Priority Training Principle: Working your weaker body parts first in any given workout.

Pre-Exhaustion Training Principle: Supersetting a lighter isolation movement before the heavier compound movement.

Pyramiding Training Principle: Start a body part session with higher rep/low weight and gradually add weight.

Descending Sets Training Principle: Using lighter weights from set to set as fatigue sets in.

Quality Training Principle: Gradually reducing the rest between sets while maintaining or increasing the number of reps performed.

Cheating Training Principle: Swing weight past the sticking point at the end of a set to add stress.

Continuous Tension Training Principle: Maintain slow, continuous tension on muscles to maximize red-fiber involvement.

Forced Reps Training Principle: Partner-assisted reps at the end of a set.

Flushing Training Principle: Doing 3–4 exercises for a body part before moving to another body part.

Burns Training Principle: 2–3-inch quick movements at the end of a set.

Retro-Gravity Training Principle: Using supramaximal loads in an eccentric only style.

Superspeed Training Principle: Compensatory acceleration of movements to stimulate hard-to-reach fast-twitch fibers.

Iso-Tension Training Principle: Method of practicing posing, tensing each muscle maximally for 6–10 seconds for up to a total of 30–44 flexes in a variety of posing positions.

- **Continuous Tension Training Principle** (Maintain slow, continuous tension on muscles to maximize red-fiber involvement.)
- **Forced Reps Training Principle** (Perform partner-assisted reps at the end of a set)
- **Flushing Training Principle** (Do 3–4 exercises for a body part before moving to another body part.)
- **Burns Training Principle** (Do 2–3-inch quick movements at the end of a set)
- **Partial Reps Training Principle** (Because of leverage changes throughout any given exercise, it's sometimes helpful to do partial movements with varying weight to derive maximum overload stress for that body part.)
- **Retro-Gravity Training Principle** (Negatives or eccentrics as they're called, make it possible to get more muscle cells to respond because you can lower about 30%–40% more weight than you can successfully lift concentrically; this is important for increased IGF-1 production and satellite cell proliferation.)
- **Peak Contraction Training Principle** (Hold the weight through maximum contraction for a few seconds at the completion of a movement)
- **Superspeed Training Principle** (This is compensatory acceleration of movements to stimulate hard-to-reach fast-twitch fibers.)
- **Iso-Tension Training Principle** (A method of practicing posing, tensing each muscle maximally for 6–10 seconds for up to a total of 30–44 flexes in a variety of posing positions.)
- **Instinctive Training Principle** (Eventually, all bodybuilders instinctively attain the ability to construct diets, routines, cycles, intensity levels, reps, and sets that work best for them.)

As you learn about the science of training and the art of programming, you can synergistically blend these principles into a holistic program. In discussions with Dr. Fred Hatfield on recovery, he repeatedly emphasized that periodization and planning are the most important factors in adequate recovery.

I agree with Dr. Squat!

SLEEPING

Sleep is also imperative to recovery. The body emits most of its natural growth hormone—as much as 70%—during **REM** (rapid eye movement) **sleep** has a profound effect on muscle growth and physical well-being.

REM Sleep: A kind of sleep that occurs at intervals during the night and is characterized by rapid eye movements, more dreaming and bodily movement, and faster pulse and breathing.

You have likely heard that the body needs at least seven hours of sleep in a 24-hour daily cycle. This holds true for "the average person." Bodybuilders certainly do not fit that category. At least eight hours of solid, uninterrupted sleep is needed for bodybuilders to optimally recover.

A recent study performed by the University of Chicago Medical School and published in the *Annals of Internal Medicine* reiterated this. The study consisted of two control groups, both on calorie-restricted, weight-loss diets. One group was sleep deprived, whereas the other had a full night's sleep every night. Both groups lost the same amount of weight in this study, but the sleep-deprived group had 25% less fat loss. Think about the potential benefits you are robbing yourself of while dieting if you are not sleeping enough.

It is important for bodybuilders to understand how sleep cycles work so they can achieve the maximum anabolic effects of rest. During sleep, the brain functions in cycles, with each one lasting approximately an hour and a half.

There are two distinct types of sleep: REM and non-REM. A sleep cycle commences with four stages of non-REM sleep; then this will change to REM sleep. Generally, five of these cycles are experienced per night.

During REM and in stages three and four, your body and brain are completely at rest. During REM, memory consolidation takes place. REM sleep literally gives your brain a chance to rest and recharge.

From a weightlifting standpoint, you will feel mentally alert, and neuromuscular maximum efficiency will occur. Nearly 50% of sleep is REM for newborns; as we age, this percentage decreases. This is why it is important to get your rest: as we age, our sleep becomes less efficient.

Stages of Sleep

- **Stage 1:** This is a stage between sleep and wakefulness. Your muscles are active, and your eyes moderately open and close. This is less than 5% of the total sleep cycle.
- **Stage 2:** Eyes dart back and forth.
- **Stage 3:** You continue to fall deeper into sleep and closer to the final stage.
- **Stage 4:** The sleep stages 3 and 4 are also referred to as sound wave sleep. This sleep is less responsive to external environment stimuli. Next, you will enter rapid eye movement (REM). REM sleep, in which you become paralyzed, is turned on by acetyl-chloride secretion and is inhibited by neurons that secrete serotonin. When you have seven to eight hours of uninterrupted sleep, you will spend a combined total of approximately 90 minutes in REM sleep, experienced over four to five sleep cycles, or an average of 18–22.5 minutes of REM sleep per cycle. This means REM sleep is 20%–25% of total sleep per night.

The Importance of Nutrient Timing and Sleep

The first meal of the day is called *breakfast*, and if you break down this word, you'll see it means to break your fast. When you are sleeping you are obviously not eating.

While you are in this necessary fast, things turn catabolic because amino acids are converting to glucose. The longer you don't eat prior to falling asleep, the deeper you fall into a catabolic state. This is not ideal for those looking to increase muscle mass. When you're properly fed, however, the opposite is true. Therefore, for those seeking to put on muscle mass, consuming a casein protein shake before bed or eating it from a natural source like cottage cheese is a good idea. Casein is a very slow-digesting protein, so it releases throughout the night, counter to what a fast-acting protein such as whey would do.

Recent research from the Weider Group confirms this by showing that bodybuilders who drank a casein shake before bed gained significantly more muscle than did bodybuilders who drank casein only in the middle of the day. You can be practically applied this research by consuming 25–50 grams of casein protein 15–30 minutes prior to bedtime.

Tips to Optimize Sleep

Often it is hard to get a good night's sleep. Even when we do fall asleep, the quality of sleep may be lacking.

The following tips can assist you in getting that good night's sleep:

1. **Have a time of inner reflection before bed.** It is much easier to fall asleep and rest being at peace with one's self.
2. **Avoid a pattern of sleeping 12 hours one night and then 6 the next.** This does not equate to sleeping 9 hours a night. A true sleep bank simply does not exist. Oversleeping and under-sleeping throw off your routine.
3. **Exercise.** Avoid intense, late-night sessions. If these were done early in the day, they would aid in a good night's sleep, but if they're done at night, the opposite is true.
4. **Avoid alcohol, caffeine, and other stimulants in the evening hours before bed.** Caffeine increases alertness, as do other stimulants. Alcohol, however,

will actually help you fall asleep, but it will greatly disrupt REM sleep; after a night of heavy drinking, you fall asleep early, but you are not really resting.

5. **Avoid sleeping pills.** These will create a dependency and should be a last resort.
6. **Get checked for sleep apnea.** Many large, muscular men have sleep apnea that can easily be treated with a CPAP device that not only will improve sleep quality and performance but also can lower blood pressure and greatly improve overall health.
7. **Optimize your sleeping environment.** Keep your room cool and dark. Sometimes even playing soft classical music can help you doze off into a restful bliss.
8. **Relax at night and avoid extreme highs and lows.** Neither promotes relaxation. If every time a certain person calls you, it results in an extreme emotional reaction, then, when you see that person calling, do not pick up the phone.

FURTHER EXPEDITING RECOVERY

At times a good night's sleep and a proper diet do not work. Sometimes when you train hard, the body still has not healed completely during the recommended recovery period. Here are some modalities that expedite the healing process.

CHIROPRACTIC CARE

Over the years, chiropractic care has received a bad rap by some because of a few bad apples, but the fact is that many top bodybuilders and strength athletes use chiropractic care regularly, as they should. Chiropractic is a natural (that is, not employing drugs or surgery) healing system that treats the whole person rather than just a disorder's specific symptoms.

In chiropractic, a licensed practitioner corrects structural imbalances of the body, called subluxations, with adjustments and manipulations of the spine and articulations (joints), through prescription of various exercises (e.g., stretching or weight training), and through the employment of various therapeutic modalities (e.g., electrical stimulation).

Subluxation refers to improper biomechanical motion between two vertebrae, which produces irritation of a spinal nerve. This can lead to back and neck pain, muscle spasm, and potential for further injury. Tight muscles, incorrect training techniques, scoliosis (curved spine), poor posture, high hip, or shoulder of misaligned spine—all can predispose a person to a subluxation.

By restoring proper alignment to the spinal column and the joints, the doctor of chiropractic can help the athlete operate at optimum biomechanical efficiency. This is important because if you are not properly functioning biomechanically, you will not be able to lift the weights necessary long enough to stay injury free. Chiropractic care can help the bodybuilder strengthen muscles, improve coordination and balance, extend range of motion, restore proper biomechanical function, achieve greater mental focus, and have more energy.

One valuable healing aid chiropractic emphasizes is time—letting the body heal itself after the structural imbalances have been corrected. Many chiropractors take their responsibility as educators seriously by explaining to the patients what they can do to enhance their own rehabilitation and that this takes time.

A good chiropractor specializing in sports should explain how to modify training techniques to prevent future injuries. The chiropractic profession in the past has suffered from much criticism from the medical establishment regarding the fundamental philosophy that chiropractic can "cure" most health problems—from allergies and migraine headaches to bedwetting and heart problems. Although the chiropractic profession was built on this philosophy, science has not proven these claims. Furthermore, not all chiropractors agree with this philosophy anyway. What can be proven, however, is that chiropractic adjustments can aid in restoring proper skeletal biomechanics, allowing the body to do the work the body was designed to do.

Competitive bodybuilders and recreational weight-training enthusiasts alike are advised to seek out (by asking fellow athletes) a competent sports chiropractor, one who emphasizes the biomechanical aspect of treatment and injury prevention.

Biomechanical aspects of treatment include testing for muscle strength and flexibility, analyzing gait, correcting weight-training techniques, and making evaluations for skeletal alignment. Many chiropractors use physical therapy modalities, including ultrasound, diathermy, ice, heat, and electrical muscle stimulation as adjuncts to the manipulations.

Many chiropractic physicians are well educated in nutrition and often recommend dietary alterations and nutritional supplements as part of the treatment program. Chiropractors also tend to be knowledgeable about stress reduction and its role in enhancing the healing process.

A typical sports chiropractic treatment program consists of two or three visits a week of 15–30 minutes each. The patient sits or lies on a treatment table, and the practitioner makes biomechanical evaluations using a variety of techniques, including applied kinesiology (AK). Some chiropractors employ computer analyses of posture, gait, or nutrition to aid in their evaluation, diagnosis, and treatment procedures.

To do the adjustments, the chiropractor gently applies pressure and/or traction on the spinal vertebrae, sometimes putting wedge-shaped blocks under the patient's hips. Sometimes, there is immediate pain relief. At times, there is slight muscle soreness while the tight, overcompensating muscles have a chance to relax into normal balance, and new muscles are called into play.

Sports chiropractors have valuable viewpoints on athletic training and injury treatment methods. Dr. Sal Arria, former director of the Santa Barbara Chiropractic and Sports Medicine Clinic in Santa Barbara, California, and team doctor for the 1984 US Olympic track and field team, believes in keeping an injured joint mobile whenever possible for speedier healing. Dr. Arria was ahead of his time in saying this three decades ago; this belief gained prevalence among sports chiropractors at the start of the 21st century.

Dr. Arria states, "New research proves that it is most important to stimulate injured joints into gentle movement, as this increases circulation. Misaligned vertebral joints have a tendency to fixate and lose mobility between the vertebral segments, leading to biomechanical changes."

This is contrary to traditional theory, which held that an injured joint should be immobilized in a cast. These days, a cast is put on when the injured joint is unstable with torn connective tissue that needs a healing scar.

"The longer a joint is immobilized, the greater the deterioration," says Dr. Arria. "When there is no stress on an injured area, reabsorption occurs,

the body begins reabsorbing muscle and even bone calcium. The result is atrophy and osteoporosis or demineralization of the bones."

When choosing the right sports medical care, you should generally opt for a conservative approach. The non-invasive techniques of chiropractic are an excellent place to start.

MASSAGE

Regular deep tissue massages are a staple of IFBB pros Ronnie Coleman, Johnnie Jackson, Branch Warren, Cory Matthews, and Stephen Fraizer along with a host of other top bodybuilders and powerlifters. Deep tissue differs from a Swedish massage (the massage most commonly provided at a spa) in that the intent of a deep tissue massage is to break up scar tissue, which in turn can accelerate tissue repair.

How massage works. Massage works by applying mechanical pressure to the soft tissue; in turn, this can increase joint range of motion, improve muscle stiffness, and reduce delayed onset of muscle soreness (DOMS).

This is not just gym lore; science is beginning to confirm the effectiveness of massage.

In one contemporary study, researchers at McMaster University showed the profound effect deep tissue massage had on the cells' "powerhouse," the mitochondria. Post-workout, deep tissue massage caused muscle to enlarge and grow new mitochondria, and as you recall, mitochondria serve to convert nutrients into useful energy.

The subjects in this study were men who rode a stationary bike to exhaustion. Post workout, the men received a deep tissue massage on one of their legs for 10 minutes. Pre- and post-training session, muscle biopsies were taken from one quadriceps muscle and then from both muscles right after a 10-minute massage of one leg and then again, two and a half hours later.

The results were that the deep tissue massage increased the number of mitochondria, along with the muscles' size, significantly more than exercise alone did. This means there was an increase in the efficiency with which muscles can use oxygen.

Another 2012 study published in the *Alternative Medicine Alert Journal* confirmed the McMaster study findings on the effects of massage on mitochondria. Furthermore, the study found that massage therapy modulates pro-inflammatory cytokines, which causes a similar effect to NSAIDs, but without the negative side effects. The study demonstrated another large benefit for the bodybuilder, by showing that massage enhances protein synthesis in exercised muscle tissue.

During a massage, blood flow can improve and increase the muscle's temperature. Additionally, a massage by a licensed, skilled practitioner sparks a heart rate reduction and decreases blood pressure. This is monumental in the recovery battle

Finally, massage can potentially reduce cortisol levels. Increased levels of cortisol spark a breakdown a muscle and an increased storage of fat. Because the name of the game is minimizing body fat and maximizing muscle mass, I will unrelentingly stress the importance for the bodybuilder, particularly the natural one, to use massage.

Selecting a masseuse (masseur). A good massage therapist needs to have knowledge of anatomy, physiology, and pathology, both theoretical and applied. Make sure your massage therapist holds a current license. Experience is important with any profession, as hands-on experience is how one becomes better. Find a masseuse who specializes in working with athletes.

FOAM ROLLING

Self-Myofascial Release: A manipulative treatment that attempts to release tension in the fascia due to trauma, posture, or inflammation.

Massage therapy can be expensive. **Self-Myofascial release** (SMR), better known as foam rolling, is much cheaper than massage therapy. A foam roller is a one-time investment that costs less than $10. Similar to deep tissue massage, SMR works by releasing trigger points because of the principle of autogenic inhibition.

Practitioners of SMR believe that the foam roller is one of the most effective tools for releasing tension in muscles and effectively improving overall range of motion.

Popular strength coach Mike Boyle has referred to foam rolling as a poor man's massage. Advocates of the foam roller believe it is nearly as effective as a massage is.

The foam roller is believed to have the benefits of correcting muscle imbalances, reducing stress, reducing pain, increasing joint range of motion, relieving muscle soreness and stress, improving the extensibility of the musculotendinous junction, increasing neuromuscular efficiency, and maintaining normal muscle length.

Foam Rolling Technique

Foam rolling is simply performed by taking the foam roller and slowly rolling it across the muscle from which you want to release adhesions and knots. The foam roller is wedged between the floor and your body weight at the specific area you are focusing on.

You want to roll at a slow, controlled paced and stop on the most tender spots, directly focusing on the localized area where pain is most persistent. Once pain ceases, then move on to rolling out another area. Increasing the intensity of foam rolling is simple: Just place a larger percentage of your body on the roller. To decrease the intensity, do the opposite.

Expert trainer Mike Robertson recommends rolling from the proximal to the distal attachment of a muscle. When rolling the thighs, roll from the top to the bottom, focusing on one specific area; do not do the whole targeted area at once. Robertson believes this sequence is important because, as you gain proximity to the distal muscle-tendon junction, there is greatly increasing tension.

In summary, you work the top half of the muscle first. Then, after that has loosened up, you can roll the bottom half. This will decrease the tension that is ensuing at the bottom of the muscle.

Foam rolling guidelines:

- Breathe slowly and controlled; this will relieve tension.
- Perform foam rolling exercises post workout and on off training days. Some advocate this as a warm-up. However, not enough studies have been performed on SMR effects regarding force production and potential injury prevention when foam rolling is used as a warm-up.
- Spend approximately 1–2 minutes per technique per spot.
- Spend 30–45 seconds on painful/tender areas.
- For best results, practice daily.

Few peer-reviewed studies have been conducted on the effectiveness of SMR. A number of trainers and physical therapists in the field swear by the effectiveness of foam rolling techniques. This is why they are included in this text. Some advocate these for both warm-up and cooldown.

If you are going to integrate SMR into your holistic program, remember this: the Golgi tendon organs (GTOs) are proprioceptors that are sensitive to tension and rate of tension change.

Stimulation of GTOs will inhibit muscle spindle activity and decrease tension in the muscle; this is called *autogenic inhibition*. This is because the contracting prime mover muscle is inhibited by its own receptors.

Like static stretching, SMR activates GTOs and potentially limits the ability to produce maximum force and maximum power.

Currently, no direct studies exist on force production effects resulting from using foam rolling prior to training.

The following is an example of an SMR cooldown program after an intense workout.

SMR Cooldown Program (Foam Rolling)		
1 set each spot, 1–2 min per spot, Roll tender spots 30–45 sec		
• Hamstrings and calves	• Quadriceps/Hip flexors	• Rhomboids
• Gluteus medius	• Adductor	• Latissimus dorsi
• IT band/Tensor fascia latae	• Low-back/Erector spinae	

CONTRAST BATHS

Contrast bath therapy, also known as hot/cold immersion therapy, is a therapeutic modality in which a portion of your body, or your entire body,

Contrast Bath Therapy: A therapeutic modality where a portion of your body, or your entire body, is immersed in cold water followed by warm water; this is done for several alternating cycles.

is immersed in cold water followed by warm water; this is done for several alternating cycles.

This is the theoretical basis of how a contrast bath works: It increases local blood circulation by vasodilatation caused by the warm water, followed by vasoconstriction caused by the cold water. Cold water causes lymph vessels to contract, and they relax when exposed to warm water. Because of the alternating temperatures, the lymph vessels help remove stagnant fluid. In turn, a favorable effect on inflammation helps expedite the recovery process of broken-down tissues.

A 2007 study published in *The Journal of Science and Medicine in Sport* showed contrast water immersion to be a valid method of hastening plasma lactate decrease during recovery after intense anaerobic exercise for both males and females. In 2012, another study confirmed the effectiveness of contrast baths.

In-the-trenches coaches and athletes from a variety of sports implement contrast baths and believe they are extremely effective in enhancing recovery from intense training.

For contrast baths, the legendary, late Charlie Francis, considered revolutionary in many of the recovery methods he helped popularize in the West, recommended three minutes as hot as an athlete could stand, immediately followed by one minute as cold as the athlete could stand. Repeat for two cycles and always finish with cold immersion. He recommended performing this activity up to twice daily. Treatment times were not set in stone. They varied based on bath temperatures, how much of the body was submerged, and the availability of baths.

A sauna might be swapped for a hot shower that would then be paired with a cold whirlpool. This technique can certainly be alternated as an effective therapeutic means to speed up recovery.

The idea is to alternate this recovery technique with other ones and to vary the time spent at each temperature; as with training techniques, the same recovery methods done repeatedly without variation will eventually lose their effectiveness in enhancing recovery and will become more of a ritual.

EPSOM SALT BATHS

This regenerative modality is somewhat self-explanatory given the name; the idea is to take a hot bath for 10–20 minutes, but the kicker is that you add 200–400 grams of Epsom.

Proponents believe this will reduce inflammation, and it is very relaxing for your muscles. For those who naturally retain water, this will help prevent extreme water retention and increase blood magnesium levels.

Charlie Francis used this technique with his sprinters when they were residually sore. He warned against using standard table salt because this would cause stimulation, not relaxation. This would impede recovery, not enhance it.

ELECTROMYOSTIMULATION (EMS)

Performed with a low-geared pulse toward restoration, this can be an effective means to decrease recovery time. The discharge frequency on an EMS unit can range from 1Hz to 9Hz for restorative purposes and should be used for approximately 20 minutes.

The Compex unit seems to be favored by strength athletes and has a setting to enhance

power, strength, and resistance. For this purpose, it has an actual active recovery setting.

Electromyostimulation: The elicitation of muscle contraction using electric impulses.

The Russians have effectively used EMS for well over half a century. EMS has been used to enhance strength, as numerous studies have shown. This works because the stimulation is low intensity and pulses the muscles very gently, which massages the muscles.

According to both Siff and Verkhoshansky, EMS used in this way will help expedite the removal of waste products caused by intense training. Because of increased localized blood supply, nutrients to the muscles will be increased. This restorative method should be done the day after intense training on the area you trained the day prior.

CRYOTHERAPY (ICE MASSAGE)

Cryotherapy: Ice massage.

The term cryotherapy comes from the Greek and is translated as *cryo,* meaning *cold*, and *therapy,* meaning *cure*.

Cryotherapy has been around for more than 300 years. In most gyms, athletes will simply refer to this method as ice massage. Ice massages are believed to decrease inflammation, pain, and cellular metabolism but increase cellular survival and cause vasoconstriction.

T-Nation contributor and well-respected trainer/author Christian Thibaudeau gives these recommendations for the practical application of an ice massage: Commence by lightly massaging in a circular motion with the ice to the muscle. As you continue, gradually increase the area you are massaging, continuing in a circular motion; this is done for about 10 minutes.

CRYOKINETICS FOR LOW BACK AND LEG RECUPERATION

Cryokinetics is therapy combining ice and movement to loosen muscles and stimulate the removal of waste products. Place crushed ice in a freezer-weight Zip-loc bag. Immediately following a shower (most effective if after a contrast shower), lie down on the floor and prop feet over a bed or couch. Place ice pack under the lumbar spine. Stretch the spine and gently perform lateral (side-to-side) flexion alternated with pulling knees to chest. These actions counteract stiffness resulting from cryotherapy. Spend at least 15 minutes, but no more than 20, on the ice.

A FEW LAST WORDS

To continually gain muscle, you need to continually overload your training.

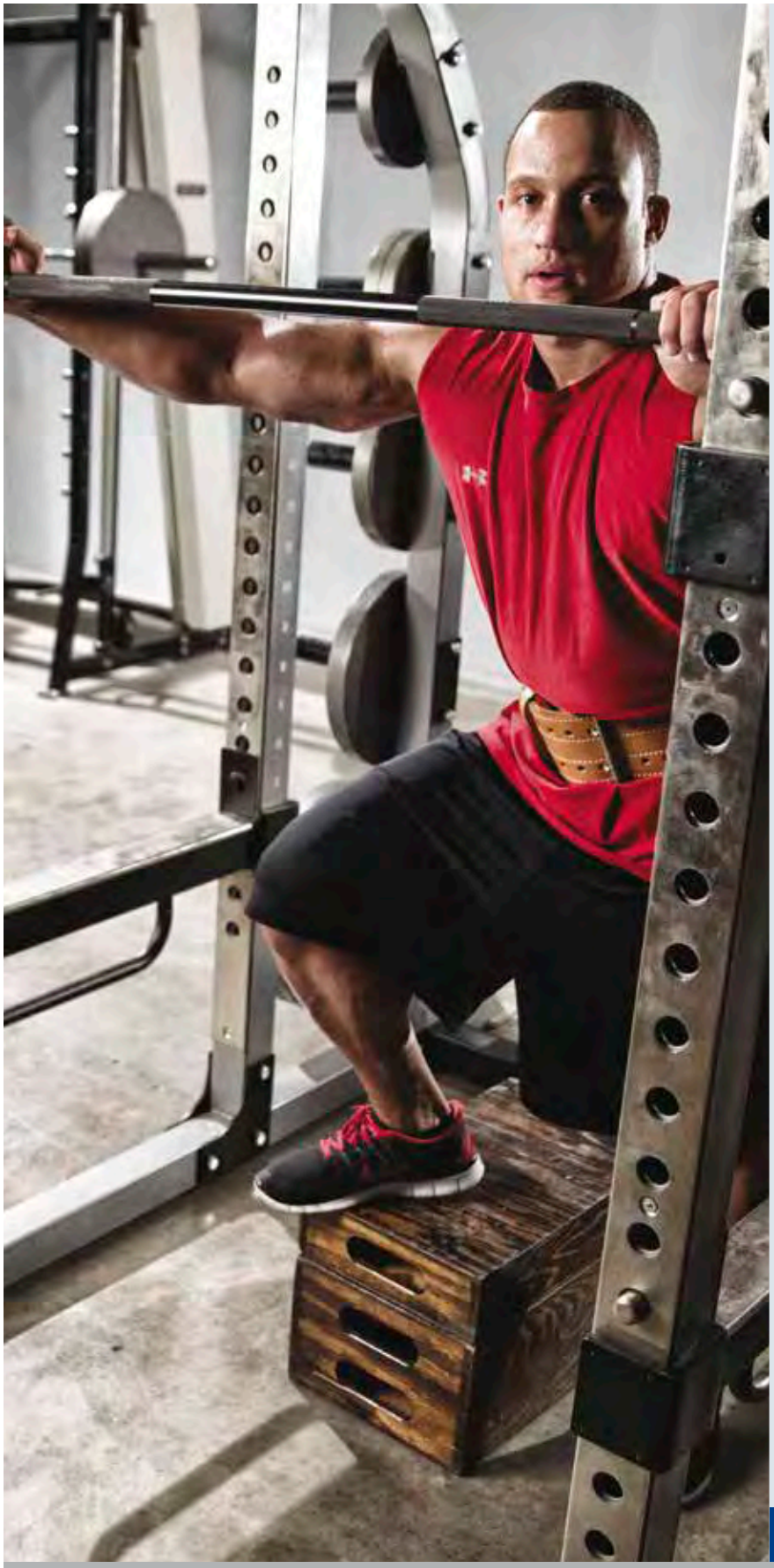
In exercise physiology, the first principle discussed many times is the principle of overload. The bigger and stronger you get, the more stress you must impose on your body from intense weight training.

Your work capacity will improve and build up over time, but when you first started out, a moderately intense 2-day-a-week full body split added muscle and increased symmetry.

As you evolve to an advanced bodybuilder, you may need 20+ sets per body part and have to use extremely intense bodybuilding methods such as drop sets and rest pauses.

This takes a toll. Although your recovery will improve, it won't be at the same linear rate that muscle size and strength do.

You can drastically improve this by implementing some of the restorative modalities mentioned in this unit. Such implementation can help keep you injury free, minimize your pain, and allow you more frequent training sessions. The result, of course, will be a better physique.



TOPICS COVERED IN THIS UNIT

Exercise

- Load Progression
- Repetition Progression
- Volume Progression
- Density Progression
- Exercise Progression
- Injuries
- Areas of Concern

Injury Prevention

A Few Last Words

UNIT 15

INJURIES IN BODYBUILDING

By Joe Giandonato, MS

To the iron community, nothing is more demoralizing than falling victim to an injury. Those chasing milestone numbers in the gym might have their personal record journeys detoured or abruptly ended by an injury.

Competitive strength athletes . . . a group consisting of powerlifters, Olympic weightlifters, and strongman competitors . . . might be forced into an early retirement or relegated to the purgatory of simply being known as the strongest person at the local commercial gym.

For bodybuilders, an injury might deliver a fatal blow to life on the stage. Injuries might carry severe aesthetic implications that could prevent bodybuilders from ascending the ranks.

Injuries, however, are largely preventable.

Along with discussing the etiologies of common injuries, the role of exercise—including the importance of adhering to proper form, incorporating corrective modalities such as self-myofascial release, and stretching—will also be discussed.

EXERCISE

Exercise is the catalyst of physiological and psychological change. Exercise in the form of strength training can deliver immense gains in muscular strength and size, as it triggers a cascade of neuroendocrine activity.

Strength training, like any other form of exercise, can be manipulated to achieve desired results. Bodybuilders enlist themselves in the never-ending quest to maximize muscular hypertrophy.

Muscular hypertrophy is the expansion of a muscle's cross-sectional area, involving the concurrent increase in myofibrilar content; the accumulation of non-contractile matter, such as water, glycogen, and myoglobin, which are stored in the sarcoplasm of the muscle cell; and the densification of mitochondrial content.

Hypertrophy is achieved by exposing the muscle to stress, namely tension, via repeated external load. High-tension forces are experienced during eccentric muscle actions (i.e., descending into a squat or bringing the bar to your chest during a bench press). These eccentric muscle actions must be overcome with a concentric muscle action to complete the movement. These muscle actions are grouped together in blocks, which consist of sets and reps.

To yield continual progress, sets and reps, along with an abundance of soon-to-be-introduced **overloading parameters**, must be appropriately incorporated.

LOAD PROGRESSION

Load progression entails the practice of simply adding weight to the bar. For example, say a bodybuilder performed four sets of 10 repetitions with 315 pounds on the barbell back squat during his last workout. For his upcoming workout, he would merely add weight to the bar, say 5 or 10 pounds, and perform the same number of sets and reps.

REPETITION PROGRESSION

The act of performing more repetitions per set with the same amount of weight previously used is another way the bodybuilder could challenge himself or herself and stimulate the muscles to respond. Instead of adding weight to the bar, the bodybuilder would again squat 315 pounds throughout all of his sets but would now add a repetition to each set, going from 10 repetitions per set to 11.

VOLUME PROGRESSION

If our bodybuilder does not want to increase the load or repetitions performed per set, he or she may tack on another set to the squat workout, going from four sets of 10 reps to five sets of 10 reps. More work is performed, and therefore the volume is increased.

Overloading Parameters: Load, repetition, volume, density, and exercise.

Load Progression: The practice of simply adding weight to the bar.

Repetition Progression: The act of performing more repetitions per set with the same amount of weight previously used.

Volume Progression: Adding another set of the same weight and repetitions performed previously.

Density Progression: A shortening of rest periods between sets.

DENSITY PROGRESSION

Say our bodybuilder initially performed his squats interspersed with a rest period of three minutes but was a bit short on time during the current workout. He could still use the same load he used in his previous workout but reduce the rest periods to elicit an improved training effect. Even seemingly nominal reductions in resting time will stimulate new growth. In fact, research indicates that shorter rest periods may maximize hypertrophy.

EXERCISE PROGRESSION

Exercise Progression: Advancing from one exercise to a different one that's more demanding.

Advancing from one exercise to a different one that's more demanding is another way to challenge yourself and elicit new growth. Say our bodybuilder elected to perform front squats instead of back squats for his next workout and decided to use the same load. Inevitably, he'd face a greater challenge using the same load for the front squats, as they tax the anterior core and quads to a greater degree than back squats do.

Additionally, intensification protocols such as supersets, drop sets, giant sets, and rest-pause sets, discussed earlier in the text, could be implemented as method progression. Also, tempo progression, based on the time under tension method, is yet another way our bodybuilder can challenge himself.

Optimally, bodybuilders should permit ample time to accumulate new stress before intensifying. Novice bodybuilders should emphasize only one overloading parameter at a time. Concomitantly intensifying multiple overloading parameters or progressing too rapidly might result in injury.

Moreover, arbitrarily performing workouts throughout your training cycle, such as joining your buddies for an impromptu lift, typically disregarding progressive overload principles, might beget injury as well. Without a plan, you can count on eventually succumbing to an injury.

INJURIES

Simply stated, but just as easily ignored, is the fact that exercise breaks our bodies down. Rest and proper nutrition make our bodies and muscles stronger and bigger. If we fail to rest and refuel our bodies, we will make ourselves more vulnerable to injury.

Novice bodybuilders fall victim to a host of training mistakes. Most notably, novice bodybuilders mistakenly place a hefty premium on the loads they use for nearly every exercise. Although continually progressing the load used on certain exercises is advisable, it frequently comes at the expense of good form among groups of novices.

As stated throughout the text, the quintessential pursuit of all bodybuilders is maximizing hypertrophy. Hypertrophy is achieved via mechanical tension, muscle damage, and metabolic stress, not by heaving barbells recklessly.

When form is compromised, ligamentous, cartilaginous, and osseous structures, which do not have contractile properties, are called into play to buffer the forces that muscles are designed to resist, which include tension, compression, extensibility, shear, and torsion. Injuries most indigenous to strength athletes affect bones, joints and their connective tissue, and muscles.

Bone Injuries

Bones: Bones provide the framework for our bodies. They cocoon organs and serve as the crux of our body's stability.

Bones provide the framework for our bodies. They cocoon organs and serve as the crux of our body's stability. Conditions that adversely affect bone health, such as osteoporosis, osteopenia, and chondromalacia, greatly affect quality of life. Although exercise fortifies bone strength, exercise performed with poor form can slowly chip away at the bone's integrity.

Repeatedly performing heavily loaded squats, deadlifts, and overhead presses with less-than-stellar form might lead to the development of microfractures on the vertebral endplates of the spinal column.

Joints: Joints function as our body's movement centers. They are an intersection where collagen based structures, which include tendons, cartilage, and ligaments, all meet as they collectively stabilize the rounded head of the bone within the capsule of the joint.

Joint Injuries

Joints function as our body's movement centers. They are an intersection where collagen-based structures, which include tendons, cartilage, and ligaments, all meet as they collectively stabilize the rounded head of the bone within the capsule of the joint.

Accrued stress from improperly performed and/or programmed exercise taxes these joint structures, while your collagen's water-containing extracellular matrix dries up, causing it to lose pliability as you age.

Articular cartilage, slivers of collagenous matter that encapsulates the ends of bones and permits seamless articulation, slowly begins to dry up as we age. Improperly performed exercise and poor program design can accelerate the degradation of collagen tissue.

Skeletal Muscle Injuries

Skeletal muscles serve as our body's first line of defense, as they dissipate external forces imposed on the body. They surround and attach to bones via tendinous insertions, which they pull on to generate movement. When functioning properly, they keep our body's skeletal scaffolding upright and stable.

Additionally, muscles insulate our vital organs and assist with bodily functions such as respiration and digestion. Strong muscles may also compensate for weaker bones and joints. Because muscles are our body's first line of defense, they are more commonly injured than bones and joints are.

Muscle injuries, which can be categorized as either acute or overuse injuries, are commonly sustained by active individuals and athletes.

Acute injuries can be further broken down into direct trauma and indirect trauma. Direct trauma is typified by a contusion that damages the muscle fibers and may lead to vasoconstriction or a hematoma. These injuries are commonly associated with contact sports. Indirect trauma disrupts the muscle fibers without contact. Indirect trauma results from excessive mechanical stress via eccentric overload.

Lifts performed with high loads, or those exceeding 70% of one's one-repetition maximum, have four phases. An acceleration phase is followed by a deceleration phase, also known as the "sticking point." A lifter who can successfully move through the sticking point will kick off another acceleration phase before hitting a final deceleration phase while completing the movement. If at any point the lifter cannot progress through one of the aforementioned phases, momentary muscular fatigue will be reached, which may precipitate mechanical stress that the muscle is not yet conditioned to handle.

Muscles are at the greatest risk of sustaining injury during an eccentric muscle action. That eccentric muscle action may occur prematurely, when the concentric muscle action is not great enough to resist gravitational and inertial forces.

Overuse injuries stem from repetitively performing a movement continually and having an insufficient amount of rest between activities. Consequent adaptations are quite problematic. A muscle that is called on to work frequently may fatigue and require neighboring muscles to pick up the slack and perform unintended roles.

In the general population, an example of such would be the sternocleidomastoid and the lateral flexors of the neck turning on and providing the neck stability, while the deep cervical flexors have either fatigued or aren't activated to keep the cervical spine stacked in its natural lordotic curve. Forward head posture results, and headaches soon follow.

Gym goers who fail to balance the force-couple relationship at the hip shared by the anterior core and posterior chain might end up relying on the lower back muscles for stability and movement.

AREAS OF CONCERN

Areas that are commonly riddled with overuse injuries among bodybuilders include the lower back, knees, elbows, and shoulders.

Lower Back

A tight lower back could inhibit neural drive to the glutes and hamstrings, which work in unison to extend and posteriorly rotate the hips. In the absence of hip extension, the body will try to compensate with torso extension.

Ultimately an injury will occur if the bodybuilder is performing a deadlift variation with hundreds of pounds in his or her hands. The spine may contort and forcefully slip into extension as the bodybuilder completes the lift.

Lower Back Injuries: Common lower back injuries include spondylosis, spondylolisthesis, spinal stenosis, interarticularis, herniation of discs.

Lower back injuries that commonly afflict bodybuilders include spinal stenosis, which is a narrowing of the spinal canal; spondylolisthesis, which is characterized by slippage of the lumbar vertebral segments; and spondylosis, which is characterized by microfractures of the pars interarticularis, a section of the vertebra wedged between the articular processes of the facet joint.

Finally, avulsion or herniation of the disc can occur, where the disc translates posteriorly, bearing down on the spinal nerves and creating unbearable pain. Typically, a lack of anterior core and posterior chain strength begets lower back injuries. If both of these areas are trained, the likelihood of suffering a lower back injury decreases.

Knees

The knees are two powerful, yet delicate hinge joints that are overlapped by a dozen muscles, many of which share attachments with the hip. When the muscles that cross the knee or run alongside the femur, such as the adductors and IT band, become tight, knee alignment becomes altered.

Many old-school bodybuilding programs heavily emphasize quadriceps training, practically ignoring the training of the posterior chain musculature, which includes the gluteals and hamstrings.

Insufficient hamstring extensibility and a lack of posterior chain strength won't permit a lifter to sit back into a squat properly and will impose shearing forces on the patella.

Compressive forces from tight muscles cause the patella to maltrack, forcing the foot and ankle to compensate. When the foot and ankle need to excessively pronate or supinate in response to what's going on above, movements that are influenced by quadriceps activity, such as jogging, walking, or gliding on an elliptical, are disrupted and may induce pain.

If the hip adductors (groin muscles) are too tight, and if the hip abductors and hip external rotators (lateral glute) are too weak, the ankle will collapse at the subtalar joint, causing pronation during static and dynamic activities. Tight hamstrings may enact more posterior force on the knee, forcing it to clamp down on the patella and the femur.

When muscles aren't firing properly or aren't working in unison to stabilize the knee, the body turns to the osteoligamentous structures for support. When an unstable knee is exposed to loaded dynamic exercises and high-impact activities, a potential disaster is likely to occur.

All exercises performed from a standing position, such as squats, deadlifts, and presses, must be performed atop a stable base of support. The feet serve as the body's base of support.

Ideally, the feet should evenly distribute the person's bodyweight and external load throughout three points on the foot—the heel, the first metatarsal head, and the fifth metatarsal head.

Muscular imbalances farther up the kinetic chain can interrupt this balanced foot position, making it difficult to get into position. If proper position cannot be achieved, the patella may slide off track and migrate laterally.

Ideally, the patella should track over the second and third metatarsal heads during all loaded activities, thereby reducing the amount of stress imposed upon the knee.

A large number of bodybuilding programs tend to ignore the importance of posterior chain training and hamstring and adductor extensibility. Moreover, bodybuilding splits are designed to induce great amounts of mechanical stress to the muscle, from multiple angles, while not focusing on rather important aspects such as mobility, flexibility, and stability training.

Ideally, the time and effort spent developing the quadriceps should be equally matched with training the hamstrings and gluteals. If these groups are targeted, you can expect to use heavier poundages on squat and deadlift variations along with more mass on your wheels.

Elbows

The elbow is another powerful yet intricate hinge joint that often gets chewed up by the volume and variety of exercises that bodybuilders use in their training programs.

The elbow falls casualty to two common conditions, lateral and medial epicondylitis. Lateral epicondylitis occurs from repeated wrist supination and pronation with the elbows extended. Think performing pull-downs and rows with a supinated grip repeatedly. During the eccentric portion of the lift and through the return to the starting position, when the elbows fully extend, the muscles remain tensioned. Barbell presses, which lock the hands in a pronated position, stress the elbows at the end range of extension.

Medial epicondylitis stems from the overuse of the wrist flexors. Additionally, performing back squats with too narrow a hand placement on the bar, or routinely performing presses with a close grip, can exasperate the connective tissue of the elbows, contributing to inflammation and pain.

To alleviate elbow pain, bodybuilders should consider performing more rowing movements

with rotating handles and dumbbells; pulling movements using suspension systems, rings, and straps; and pressing movements with dumbbells and multi-handled bars.

Although you might not be able to use the equivalent loads you'd be able to use on bilateral barbell movements, you'll spare the wrists by allowing them to move freely throughout the movement, which may cause the prime mover to contract even more fully. In addition, self-myofascial release can be incorporated, as can stretching the wrist flexors and extensors.

Shoulders

The shoulders actually consist of four distinct joints: the scapulothoracic, glenohumeral, acromioclavicular, and sternoclavicular joints. Communally, these joints work to provide smooth articulation of the shoulder.

The chief players, the scapulothoracic and acromioclavicular joints, will be discussed. It should be noted that having mobility through the thoracic spine is also critical and, along with the synchronous proper functioning of the four shoulder joints, will keep the shoulders healthy.

Scapulothoracic Joint

Unlike the other three joints mentioned, the scapulothoracic joint has barely any ligamentous or capsular support. All of this joint's stability derives from the optimal functioning of the 17 muscles that anchor themselves to the joint. The scapulothoracic joint is critical in keeping the shoulders healthy.

Experts suggest that the scapulae must be stable to permit optimal movement of the shoulders. When the dynamic or static stability of the scapula through its actions of retraction, depression, and upward and downward rotation cannot be achieved, the shoulders won't be able to properly rotate, which might lead to impingement over time.

Acromioclavicular Joint

The acromioclavicular joint, or rotator cuff, is regularly associated with impingement. An impinged shoulder will affect the load you can press horizontally and overhead and may be accompanied by pain. The joint, or cuff, is encircled by four muscles, which include the supraspinatus, infraspinatus, teres minor, and subscapularis.

Together these muscles compress the head of the humerus, or shoulder, into the cavity of the shoulder blade. These muscles counteract the pull of the pectoralis and latissimus groups, which are powerful internal rotators of the shoulder.

Bodybuilders oftentimes disregard corrective exercise for the shoulders. Frequently bodybuilders fight through the pain, risking considerable damage to their shoulders down the line. Bodybuilders and lifters in general should insert more thoracic mobility drills (extension and rotation work) throughout their workouts and adopt a greater horizontal pull-to-press ratio.

The ratio should favor the horizontal pulling, as it will strengthen the muscles that retract the shoulders, helping them gain the static and dynamic strength needed for pressing exercises. For every pressing exercise, one should perform two horizontal rowing exercises.

Once lifters become proficient at horizontal rowing, they may progress to face pulls, in which the shoulder is both externally rotated and abducted from the body, and finally to vertical pulling. In addition, substituting bench press variations (open chained) with push-up variations (closed chained), with or without added load, will force

the rotator cuff to stabilize the shoulder, making the scapulae retract while challenging the core musculature.

INJURY PREVENTION

Luckily, preventing injuries is quite simple. Though common sense practiced in the trenches of a gym is rarer than a parallel squat, good judgment will help save you from the anguish of missed time in the gym. The following are 13 tips that will keep you from forking over copayments and spending a couple of hours each week hanging out in dingy patient rooms with men and women in white coats.

Tip #1: Check your ego at the door. Bodybuilders are assumed to have established appreciable strength levels throughout their years of lifting. Nevertheless, some bodybuilders don't get it. Certainly, pushing the envelope for strength gains will help you gain hypertrophy; however, using backbreaking weight week in and week out with horrid form will precipitate injuries.

Remember, if you're seeking to optimize muscular hypertrophy, moderate to heavy loads (between 70% and 85% of your estimated or actual one-repetition maximum), performed within a range of six to twelve repetitions per set, is ideal.

Additionally, you should employ short rest periods, ranging from one to two minutes each, as the short rest periods prompt a greater secretion of anabolic hormones, particularly growth hormone.

Tip #2: Pay close attention to your posture. Are you seated for the bulk of your workday, or are you standing? An optimal posture is one that's constantly moving. Get up from your desk, walk around, and stretch throughout the course of your work or school day.

Tip #3: Stretch! The S-word has evolved into a taboo among bodybuilders and gym goers, as isolated studies have indicated that static stretching potentially reduces force output. However, stretching is indeed necessary to restore muscles back to their natural resting lengths.

Regularly stretching can also help range of motion, alleviate post-workout soreness, reduce fatigue, and help the body relax. It is advisable to perform a thorough dynamic warm-up prior to your workout and to conclude your workout with static stretching.

Additionally, you can perform some static stretches a couple of hours following your workout or immediately before bed to help calm your body before sleep.

Tip #4: Perform self-massage. You know those weird things that resemble oversized pool noodles in the corner of the stretching area of the gym? Well there's a reason gym owners have started stocking their facilities with foam rollers.

Foam rollers, in conjunction with PVC piping, softballs, tennis balls, and lacrosse balls, are used to iron out nagging adhesions found in the multiple layers of the fascia, which sit beneath the skin and encapsulate skeletal muscle.

Improvements in soft tissue quality and musculotendinous extensibility and gains in joint range of motion are some benefits that self-myofascial release packs. Self-myofascial release also shifts cellular fluid balance, promotes blood flow, and helps reduce sympathetic tone, allowing the body's muscles to relax following exercise.

Tip #5: Hydrate. Hydration directly affects soft tissue health. Muscles and their surrounding fascia consist largely of water. The extracellular matrix, which contains collagen, elastin, and colloidal gels, needs to be hydrated to permit

smooth movement. Water also significantly contributes to the elasticity of the fascia and the muscle it covers.

We know that dehydrated individuals are more apt to cramp, but they are also more prone to injury. Bodybuilders should aim for a gallon or more of fluid on training days, increasing fluid intake in warmer climates and/or if they're performing extensive cardiovascular exercise.

Tip #6: Learn proper biomechanics of exercise. Nuances include learning how to pack the shoulders during pressing movements, sitting back into a squat, and learning how to properly brace your core musculature during full-body compound movements.

Novice bodybuilders should strongly consider linking up with a qualified personal trainer or a bodybuilder who has years of experience in the trenches and truly knows how to perform various exercises correctly.

Tip #7: Don't get too caught up in the numbers you move. Although gaining strength is important, bodybuilders should be dogmatic in their pursuit of gaining muscle mass, not surpassing their previous personal records each workout.

Muscles don't know how much load you're lifting; they only know tension. Many of the techniques discussed earlier have provided you with myriad ways you can expose your muscles to tension.

Tip #8: Learn how to breathe properly. Oftentimes, breathing incorrectly begets injury. Ideally, you should learn how to breathe through your belly and keep the muscles of the core tight, creating intra-abdominal pressure. This constant pressure provides the core musculature the rigidity it needs to keep your body stable throughout the course of the lift.

Remember to breathe during sets, inhaling during the eccentric and exhaling during the concentric—blowing through the second phase, or "sticking point" of the repetition.

Additionally, proper breathing during exercise and throughout the day helps control autonomic nervous system activity, prevents the body from over-alkalizing, and decreases acidity.

Tip #9: Don't shy away from body-weight exercises. Body-weight exercises pack a tremendous value for the bodybuilder.

First, they help establish relative strength, which many novice bodybuilders and heavier bodybuilders lack.

Second, they require little to no equipment. Examples include push-up variations, sit-up variations, planking, lunging, and squatting variations. If you have a set of parallel bars and a pull-up bar available, or access to a playground, you can add in pull-up and chinning variations along with dips.

Bodyweight exercises can be incorporated in the dynamic warm-up or as finishers to conclude the workout. They also serve as a novel way to break up the inevitable monotony of working out at the gym.

Tip #10: Know when to deload. Your CNS, musculoskeletal system, joints, and connective tissue all need a rest. Often, when strength and size are gained too rapidly, the musculotendinous junction, the force-generating component of functional movement where the muscle blends into the tendon, becomes inflamed as it struggles to support the muscles that have swelled in size.

Merely ramping up the repetitions per set and scaling back the intensity of movements for a few months out of the year will help you establish

tensile strength of connective tissues. Substituting loaded exercises for body weight exercises will also help the cause.

Tip #11: Prioritize and periodize. Ask yourself what you, the bodybuilder, need to work on. Do you suffer from any muscular imbalances? Are there some aesthetic flaws you'd like to address?

Honestly assess yourself and devise a plan to help you get where you need to be. The plan will come in the form of a periodized program.

If strength and hypertrophy are desired, remember there are no shortcuts. However, there are two surefire means of accomplishing those goals: systematic progressive overload and consistency.

Gradually increasing and manipulating the aforementioned overloading parameters will continually yield results. If you are consistent with your approach and carefully adjust the overloading parameters, you will cultivate a stronger and more muscular physique.

Tip #12: Get more athletic. Although professional bodybuilders are heaping mountains of chiseled muscle, it's doubtful that many of them could engage in a game of pickup basketball or flag football. Although bodybuilders want to gain as much muscle as possible, gaining a bit of athleticism will not necessarily hurt.

Consider embedding elementary agility drills and low-level plyometric exercises within your dynamic warm-up. Jumps and short sprints will help excite the CNS, fostering a brief training effect that will permit you to lift heavier during your workout.

Tip #13: Warm up extensively. A pre-workout warm up should be thorough and should encompass directed mobility and flexibility work along with movement patterning and arousal activities. Foam roll and stretch what's tight, perform some body weight movements, pattern the movements you'll load heavier later in your workout, crank up the music, and get going. While the music is pumping, perform all of your warm-up sets in the fashion you'd perform your work sets.

Treat the light weights heavy and imagine that the heavier weights are light. Execution should look identical on each lift. The stronger you are, the more time you'll need to devote to your warm-up.

Additionally, do not perform warm-up sets with high reps. The goal of the warm-up is to get the body acclimated to the heavier loads and more intense work that takes place later in the workout.

A FEW LAST WORDS

Bodybuilders must be cognizant that their quest to add muscle doesn't end at a destination; it's a continual journey, and a surefire way to ensure longevity is to take care of the body you have.

If you adhere to the aforementioned tips, you'll safeguard yourself against the injuries, both acute and chronic, that bodybuilders face throughout their careers.

About the Author

Joe Giandonato, MS, is the head strength and conditioning coach at Germantown Academy in Fort Washington, Pennsylvania, where he develops and oversees the programming for 88 sports teams. In the off-season, Giandonato also works with a number of the school's alumni who are competing collegiately and professionally. Previously, Giandonato served as an intern assistant

strength and conditioning coach at Saint Joseph's University. He also worked as a health coach and implemented wellness programming at the Children's Hospital of Philadelphia and the University of Pennsylvania. Giandonato has authored over 100 articles that have appeared on numerous of popular fitness websites, and he has served as an adjunct instructor at a number of Philadelphia-area colleges.

TOPICS COVERED IN THIS UNIT

Bodybuilding versus Traditional Sports

- Bodybuilding Difficulty
- Conditioning Your Mind for Bodybuilding
- Twelve Motivational Strategies for Workout and Bodybuilding Success
- Mental Conditioning Program

A Few Last Words

UNIT 16

BODYBUILDING SPORTS PSYCHOLOGY

The straight and narrow path to achieving a championship physique is initiated by many, but few actually succeed.

Why?

A big reason is that they aren't mentally prepared. Mental breakdowns lead to physical mistakes, which can be the beginning of a perpetuating self-sabotaging cycle.

Your hard work and commitment have given you a body with a new level of muscularity, proportion, and definition. Yet, in the process, you have completely abandoned any social life you once had. Incredible dedication indeed, but it comes at a price. Other sports enhance your social life; few champion bodybuilders have a sparkling social life.

BODYBUILDING VERSUS TRADITIONAL SPORTS

In other sports, such as football, everything boils down to the game; in boxing, it boils down to the fight. Posing on stage is less difficult than is being in a football game or a boxing match. Football and boxing are physically exhausting and mentally demanding, and you face opponents who want to physically hurt you.

Posing on the competition stage is mentally demanding, but no opponents will try to physically harm you, and posing is not as physically demanding as an intense training session is.

In football, you practice against your own team, and your team shares your goal of winning; therefore, teammates are not trying to physically harm you. Scrimmaging is rarely done in a best-on-best scenario or at 100%.

In boxing, the same thing occurs. Sparring at 100% against an opponent who wishes to physically harm you is extremely rare. However, bodybuilding is the opposite, as the most grueling part is the training and the diet, with the competition being almost anticlimactic.

BODYBUILDING DIFFICULTY

Bodybuilding may sound less mentally demanding than other sports, but it isn't!

After a great football practice, the team can go out and celebrate by grabbing pizza. Celebratory meals are not an option for the bodybuilder in contest-prep mode. If you cheat on your diet as a bodybuilder, it will be impossible for you to look your best on stage. In bodybuilding, you are the master of your destiny.

A linebacker can pick up a missed tackle by a defensive lineman. Team sports, to a certain degree, allow for mistakes to be corrected by a teammate. This is teamwork in action.

Bodybuilding is a lifestyle that requires an enormous mental commitment. No matter how great your genetics may be, they will matter little if your mental game is not top-notch. When you bring your A-game mentally, the physical will follow. Moving forward, your chances of being victorious on stage have dramatically increased.

Let's talk about how you can do just that.

CONDITIONING YOUR MIND FOR BODYBUILDING

If you want to be a championship bodybuilder, never forget that the mind and body work as a team. If you consistently visualize success, you will consistently succeed. To become a winner, practice the skill of "thinking like a winner."

Associating Sacrifice with Success

According to self-help guru Tony Robbins, pain and pleasure are the guides you use to make

decisions. When you have been dieting for months and training hard, what do you think about—moving toward pleasure or away from pain?

Some view this process as complete self-deprivation and torture to the point of obsession. This is all they think about, all they talk about. Every time they espouse these negative thoughts and words aloud, they become like a prayer or powerful chant. When athletes hail themselves as martyrs, they reduce their chances for success.

Diet is associated with pain and suffering, which is one reason Western society has a skyrocketing obesity rate. Even for those who survive the "suffering" of dieting, usually the weight is gained back rapidly.

Why?

Someone can only endure self-torture for so long. In the paradigm of pain and pleasure, diet and training cannot be viewed within the spectrum of pain. This is a quick path to not reaching your goals.

What about bodybuilders who are routinely successful?

Generally, they envision the great benefits derived via training and diet by painting a mental picture of themselves walking up to get the first place trophy at a contest. For a non-competing college student, the mental picture might be having the best body at spring break in Panama City. An overweight man may just see himself talking to pretty women with confidence.

All these scenarios operate within the pleasure paradigm. These examples focus on the positive results achieved through hard work instead of the discomfort of hard training and extreme dieting.

What do you focus on?

Bodybuilding is physically demanding and mentally exhausting. The right mindset increases your chances of success and, more importantly, helps you enjoy and appreciate the process. This sport is a lifestyle. A much greater amount of time is spent training and dieting than on the competitive stage, so have fun and focus on the positive!

Failure does not exist. There are only results.

When Thomas Edison was asked whether he was frustrated after trying to construct a light bulb 9,999 times without achieving his desired result, his response was, "I have learned 9,999 ways not to make a light bulb," and further added, "Every wrong attempt discarded is another step forward!"

If your bodybuilding goals have thus far not panned out with the desired results, you can view this as a positive. You now know what not to do.

These six strategies can help you achieve your goals.

Step 1: Define your goal clearly and write it down. This means being specific about what you want. Gaining size is not a goal, but adding half an inch to your arms is. Increasing your squat by 50 pounds in 12 weeks has a higher outcome of success than simply "getting your legs stronger." Goals need to be clear, concise, and measurable.

Step 2: Devise a series of short-term goals, which will ultimately lead to realizing your main goal. It's easier to attain a short-term goal that's within reach than to try to make great leaps and bounds of progress all at once. When you try too much at once and fail, you tend to get discouraged. Instead, set a number of short-term goals that you can accomplish and then knock them off one at a time. Focus with tunnel vision on the task at hand, one goal at time, knock one off, and then move to the next. Each one of your short-term goals should lead you to completion of your major goal. And as you complete each short-term goal, you motivate yourself to continue training.

Success breeds success!

A 1998 study published in the *Physiology & Behavior Journal* had participants give a saliva sample before and after their favorite team played. The average testosterone level significantly increased in the fans of winning teams but decreased in the fans of losing teams.

Imagine what happens to *you* personally when you succeed. Stress/losing produces cortisol, and success/winning increases testosterone production. Therefore, not only is the right mindset important, but also by repeatedly experiencing success, a more anabolic environment is created.

Step 3: Create strategies for your success. This is your game plan. On the same sheet on which you wrote your long-term goal and listed the short-term goals that will get you there, you should break down your daily activities into the best means to get you where you're headed. This means the routines, exercises, sets, reps, intensity, rest periods, diet, and so on. Keep a training journal. Follow your own plan to success. Prepare a daily schedule that takes you in the direction you want to go. Keep your goal sheet current and review it day by day.

Step 4: Visualize yourself succeeding. No one would attempt to build a house without a set of blueprints. Likewise, you must plan your success strategy and actually "see" yourself, in your mind's eye, accomplishing your goals. Your inner feelings, your thoughts, and your daydreams must all be filled with images of your ultimate success. Twice a day—once after training and once before bedtime—read from your goal sheet aloud. Then, close your eyes and with crystal clarity, see yourself performing perfectly, exactly as you want to. See yourself actually accomplishing your goals, not just wistfully thinking about meeting them.

Step 5: Align your mind, body, and spirit with achievement. By affirming your commitment to your stated goals, and actually visualizing and verbalizing your commitment, you will find that your mind, body, and emotional self all become one. The power of this union will send an emotional supercharge to your body by actually stimulating secretion of your body's "emotion-producing" biochemicals. The alignment is accomplished by actually verbalizing your commitment while visualizing it. Repeat your commitment statement before, during, and after your success visualization every day.

Step 6: Give yourself a reward for your accomplishments. After you've achieved a sub-goal or goal, give yourself a reward or treat of some sort. Buy yourself new clothes or a needed item, or even a luxury one. Reaffirm the good feelings in your mind and dwell on your achievement and your success. Congratulate yourself and savor the feelings of pride and confidence in having taken direct action to make you better and stronger.

The key to mental conditioning is to make your new thoughts and new approach a habit. Thoughts become words, words become actions, and actions become your destiny. The more regular your new habit becomes, the more quickly these old and destructive habits fade away. The only way to continue making progress is to regularly reinforce your new, goal-directed training. Remember the old cliché: "Once is an accident; twice is a pattern."

It usually takes about three weeks to implement this revised way of thinking. During that time, you're likely to feel tempted to return to old patterns and habits. Don't do it!

The more you resist old habits, the stronger you'll become, until you develop an iron will to succeed and you no longer even think about returning to those old habits.

Remember to create a goal, visualize it as real, and work regularly to attain it. You will get there!

TWELVE MOTIVATIONAL STRATEGIES FOR WORKOUT AND BODYBUILDING SUCCESS

1. **Set short-term goals in writing.** In a famous survey of Harvard graduate students upon graduation, only 3% had written goals and plans; 97% did not. Ten years later, the 3% with written goals were making 10 times the money that the other 97% were put together.
2. **Short-term goals should lead you to a long-term goal.** Allow for occasional setbacks along the way, but regard them as learning experiences, thereby turning those setbacks into something positive.
3. **Set a training schedule and stick to it.**
4. **Make pain and fatigue work for you.** You see them as signs that your all-out effort is helping you attain your goals; again, remember the pain-pleasure paradigm.
5. **Challenge yourself in your training.**
6. **Devise your own, personal definition of success.** It's what you say it is, not what someone else says it is.
7. **Believe in yourself and foster positive aggression in your training.**
8. **Keep track of training personal records (PRs).** You will feel good when you break them.
9. **Listen to a mentor's advice and apply it to your workouts.**
10. **Take pictures.** They can be more effective than words are.
11. **Build strong self-confidence.**
12. **Take action!**!

MENTAL CONDITIONING PROGRAM

Mind power and successful mental conditioning come only with a sustained and sincere effort. You can't simply make a wish, hope that it comes true, and then forget about working to achieve that goal.

The mind reacts much the same way the body does. If you train and condition the mind regularly, it will respond with a performance that you can always count on and be proud of.

Some of the core ingredients to an effective mind conditioning program are motivation, incentive, visualization and, most important of all, belief.

A 2009 study published in *The Perceptual Motor Skills Journal* showed that when athletes believe in their competition training plans, the athletes are more likely to be victorious in their respective sports.

The power of belief might even be related to fatigue.

A 2009 study published in *The European Journal of Applied Physiology* titled "The Limit to Exercise Tolerance in Humans: Mind over Muscle" challenged the notion that fatigue causes exhaustion and demonstrated that exhaustion might be caused by perceived rate of effort.

What does this mean to you?

It means *you have to believe*.

You have to believe in yourself, in your talents and capabilities, in your goals and all you hope to achieve, and in your methods for achieving them.

The beginning of understanding what your mind holds in store for you is a simple realization. You must realize that within you is all the power you need to succeed in both training and dieting,

which will ultimately lead to success in competition. Within you is all the potential for success. Within you is the brainpower of a superhero.

Once you realize this—that your mind holds a vast wealth of knowledge, control, power, ability, and potential—you can start to tap into that power. You can delve into your own secret depths and discover what you're really made of.

The Incentive Factor

Motivation begins and ends with incentive. You have to know what you want and why you want it. In conditioning, this means you must desire a specific improvement. Better symmetry, reduced body fat, or sheer muscle mass are various incentives, and they are part of larger incentives, such as being liked and admired, being a winner or achiever, enjoying success, shaping a personal identity, gaining peer acceptance, and so on.

The Emotional State of the Bodybuilder

Your mind and your emotions are tightly linked. It's up to you, as the athlete, to find a balance between them and to exert some degree of control over them.

Your emotional state plays a large role in your overall bodybuilding success or lack of success. The way you feel inside has repercussions for your behavior and performance on the outside.

Many different factors go into the makeup of a solid emotional base. Some of these are personal life, sexual life, family life, job, daily schedule, diet, financial matters, health concerns and, most importantly, self-esteem.

Your own self-esteem greatly contributes to your level of success in bodybuilding and in life!

Concentration

Success in bodybuilding can somewhat be likened to the practice of Zen masters. The concentration is so complete, that there is no consciousness of concentration. Frank Zane has talked extensively about this. Branch Warren's career has been proclaimed finished numerous times, yet he keeps coming back better and better. This is purpose-driven focus and concentration.

You have no doubt been in a situation in which your attention was so rapt and was so absorbed in one thought that you completely blocked out all other thoughts. This was probably due to your high concentration level on some thought of great importance to you.

For the bodybuilder who wants serious results, the gym is not a social club.

Enjoy seeing your friends, but always remember that you go to the gym to train.

In other sports, generally, the best performances are nearly always those that are executed just below total consciousness. This is how training must be focused and be purpose driven.

Approach training this way, retreating to your own mind, a magical place in which there is no pain and no discomfort and only positive forces loom.

In the antiquated world of the Samurai, this was called "mindfulness." When you are in a state of mindfulness, you are aware of all that surrounds you, but all that is around you does not deter the focus within you.

This type of focus builds confidence.

The more you focus on what you're working to achieve, fewer distractions will enter your awareness. This lifts you out of the state of mind that

can't "visualize" success. Once you begin to "see" success, you gain an edge over the competition.

Little by little, you concentrate more and more, until you're unaware of anything in your way. You see your way clearly to victory and success.

This is complete concentration.

This type of total concentration comes to those who develop total self-confidence. You must have high self-esteem and high motivation and be consistent in your training and sports conditioning program.

You must develop your mind conditioning to the point that total concentration is merely a learned response, one you no longer consciously think about.

In other sports, if you don't do your best, you share the blame with the team. In bodybuilding, everything is your responsibility. If you enter a contest in sub-par condition, you alone will suffer the consequences and humiliation.

The Perils of Overlooking Mental Preparation

I cannot overemphasize the degree to which mental preparation is often overlooked in bodybuilding.

Your conscious mind deals with things at face value, such as reasoning, logic, communications, and things of that nature. Most people believe that they operate only in this part of the mind. This part of your mind, however, is only a very small percentage of your total mental capacity.

The subconscious mind directly influences your concept of self. The power to achieve and do great things is in your subconscious mind. The truth is that you must believe to achieve.

In the 1950s, clinical and experimental psychologists proved that the human nervous system is unable to differentiate between a real experience and a vividly imagined, detailed experience. This does not mean that you can repeat 10 times a day, "I will be a Mr. Olympia," and it will happen. That would be a passive experience.

For the nervous system to believe it is doing what you are imagining, you must create a vivid mental movie, complete with the feelings, sights, sounds, and smells that would accompany the experience in real life. You need active experiences to positively affect your subconscious mind.

The discovery of self not only can help an athlete's training but also, more importantly, can even aid you when you pose on stage in front of a crowd.

T. F. James was quoted more than 50 years ago in *Cosmopolitan* magazine as saying, "Understanding the psychology of the self can mean the difference between success and failure, love and hate, bitterness and happiness."

Our triumphs, our failures, and other people's reactions to these triumphs and failures form our concept of self. In other words, our experiences shape our self-image. It isn't so much the actual experiences but the way we perceive these events.

The good news is that the human nervous system cannot tell the difference between real and imagined experiences, so start seeing yourself and everything you do as a success!

Here's an example.

Bruce is a local-level bodybuilder who has never placed in a show. If Bruce believes he is just a mediocre local-level bodybuilder, he will never evolve beyond that.

The limits you place on yourself literally become a self-fulfilling prophecy. If you prophesize championships, they are much more likely to happen.

Bad genetics?

Generally, those who don't experience success believe they are a product of bad genetics. Clearly your genetic blueprint can enhance your chances of success. The flip side is, though, very few have even scratched the surface of maximizing their genetics.

For us to experience positive change, a metamorphosis at our core's being must take place. Once we establish a healthy self-image, it is easier to accomplish things within the realm of this new self-image.

Prescott Lesky, considered one of the founding fathers of self-image psychology, conceived personality as a system of ideas that seem to maintain consistency with one another.

Thoughts and goals that are inconsistent with this system of ideas are not acted on, whereas ideas aligned with this system are acted on. Lesky emphasized that at the nucleus of this system of ideas lies an individual's concept of self.

The creative mechanism within every individual is impersonal. It can work automatically to help an individual achieve success or failure. Yet, this depends on the goals you set for yourself. Present it with positive goals, and the "success mechanism" will set in. Present it with negative goals, and the "failure mechanism" will set in. Our goals are mental images developed in the conscious mind. Self-fulfilling prophecies, whether positive or negative, are indeed real.

The great Scottish philosopher Dugold Stewart once said, "The faculty of imagination is the great spring of human activity and the source for human improvement."

That old Scotsman was onto something.

A study in 2009, published in *The Journal of Exercise Psychology and Human Perception Performance*, echoed Stewart's words. The study was called "Evidence for Motor Stimulation in Imagined Locomotion." It showed that people who imagined movements prior to performing them performed these movements better.

Think about this.

For you, the bodybuilder, optimal exercise technique is a necessity to achieve optimal results.

Mental imagery, if one wishes to be the best, should become a regular component of training. Know what your current goal is and know, without a doubt, that you will accomplish it. After that, look to the future. Find a new target and focus in with laser-like precision.

According to the late Dr. Maxwell Maltz, author of the famed book, *Psycho Cybernetics*, humans are teleological, goal-oriented beings. We are engineered to always be seeking and achieving goals.

This means you must set specific goals for yourself as a competitor and in training. Training goals need to be specific, measurable, and realistic.

Goals need to be established for the microcycle, mesocycle, and macro training cycles. Each unique phase has a unique goal that helps you achieve the ultimate goal of reigning victorious on or off stage.

Do you know where you want to be one year from now?

"To do my best" is not a proper goal. It is convoluted and open to interpretation. In general, people with no goals feel that their lives are not worthwhile. The truth is, these people may have no worthwhile goals.

Humans are hardwired to achieve goals and conquer obstacles. In bodybuilding, as with other sports, losers tend to make excuses about their

jobs, money, or training partners, whereas the winners are victorious and keep doing their thing.

Brain activity precedes movement, and it is vital that correct movements are visualized long before those movements are performed.

Weight-training exercises are movements; they are your sport! Visualization techniques were used by top Russian and Eastern Bloc coaches for decades before the rest of the world accepted them. They work!

The Mental Imagery Program

Each day, set aside 20 minutes for mental imagery training. Find a dark, comfortable place to lie down and to relax your muscles. This should be a place where all the anxieties and troubles of everyday life can be forgotten.

Start developing a "movie" in your head—a movie where you are the star. Successful visualizations benefit from as many details as possible. This can be of you training at the gym or of posing on stage, hitting every pose with perfect precision. If it is training at the gym, envision details of the gym, the look, sounds, and smells—make it real!

This experience should be like a vivid dream, the kind in which you wake up and feel it has actually happened. You want your central nervous system to have a real experience. After experiencing this vivid dream, the real life experience may seem like déjà vu. You have already experienced this. Your subconscious mind says so, and that is where the power of achievement lies.

Visualization will not be accomplished through strain or effort. It is instead achieved through relaxation. Try to systematically relax your muscles, one muscle group at a time. Then start to develop the movie in your head. Play back in your mind your past successes such as a successful competition or any event that was positive.

Reflecting on past victories and successes is helpful in defining a positive self-image. The key is to help these positive experiences build a base for your psyche. Realize with proper focus that the future will be better and begin to view that with nostalgia.

Louie Pasteur once said, "Chance favors the prepared mind." Moreover, Napoleon Bonaparte role-played, and so did General George Patton. Both these men were prepared for almost any situation that could arise because they had mentally prepared for them.

Envision yourself not only as a major bodybuilder but also as a "big deal." As you become increasingly successful in the iron game, people will come to you for advice. Envision your new role as one of bodybuilding's elite and the admiration and notoriety that comes with this new status.

If you have the freedom, it can be helpful to decorate your workout facility. Posters of past greats can serve as a great motivational tool. You should post heroes you admire and who will motivate you to become better.

You now know how to create a positive self-image, but what about negative people and the negative energy they bring? The key is to distance yourself from these negative energies as much as you can. If you can't, simply pay them no mind.

Do not hate these people. Hate and contempt breed resentment. Resentment, in and of itself, is a negative energy. Remember, the opposite of hate is not love but apathy. Let go of those who try to influence you negatively. Wish them the best as they travel on their life's journeys and you on yours.

Let your energy flow in a positive direction, not in the direction of someone you don't like. Save

all the energy for yourself, the ones you love, and the ones who support you.

Many years ago, the YMCA was onto something powerful when it proclaimed, "Sound mind, body and spirit." All three must be exercised in concert to produce synergistic results.

Truly, you are what you believe!

A FEW LAST WORDS

Congratulations on completing the ISSA's bodybuilding course! You are now equipped with the knowledge needed to successfully train a bodybuilder, or compete yourself! My hope is that you will see how many of these bodybuilding methods will not only help you train bodybuilders, but that they will also assist you in training ALL your clients (regardless of their interest in the sport of bodybuilding).

We learned about different methods, styles of training, exercises, and why they work. Rather than a bodybuilding "how-to" guide, use this text as an outline. One major takeaway I want you to have is that there is no one right way to train. Rather, there are many ways to achieve success. Each individual client is going to be different, but you are now armed with all the ammunition you will need to create individualized programs.

Welcome to the wonderful world of bodybuilding. **Now go train!**

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GLOSSARY

20-rep Breathing Squats: This method involves doing a set of 20 repetitions in the squat with a weight you would normally do for 10 reps. Do as many as possible, and just when you feel like you will fail a rep, take 3–4 deep breaths and continue until you reach 20 reps.

A

ABC Bodybuilding Periodization Model: A system of training developed by Dr. Fred Hatfield with numerous variables pertaining to recovery. Some of these variables include tolerance to pain, level of "psych," and amount of rest between workouts. Hatfield also determined that the "slow gainer" and the "fast gainer" have different recovery periods.

Abduction: movement of a body segment away from the midline.

Actin: Long, thin filaments that make up part of myofilaments.

Active Recovery: Exercising with gradually diminishing intensity immediately after a bout of vigorous exercise.

Adduction: movement of a body segment toward the midline

All or None Theory: Each myofibril could be described as a fundamentalist in its functioning. It knows nothing less than total contraction, as it responds with an all-or-none reaction. A core point here is that a motor unit is either completely relaxed or fully contracted.

Amortization: amortization phase is that brief moment between the eccentric and concentric contraction.

Anabolic and Androgenic Steroids: Synthetic substances related to the male sex hormones (androgens.) anabolic effects of the drugs promote the growth of skeletal muscle, and the androgenic effects promote the development of male sexual characteristics.

Angle Q: Angle Q involves starting strength (being able to turn on as many fibers as possible at once, instantaneously).

Antagonistic Muscle: A muscle that acts in opposition to the movement occurring at the joint.

Antioxidants: a substance such as vitamin C or E that removes potentially damaging oxidizing agents in a living organism.

Assistant Mover: A muscle that assists a prime mover in overcoming resistance.

B

Barbell Complexes: Barbell complexes are performed as quickly as possible, moving from exercise to exercise with no break.

Bilateral Deficit: When a joint on one side of the body has significantly different ROM.

Bioelectrical impedance: Measures the resistance of body tissues to the flow of a small, harmless electrical signal.

Biomechanics: science that examines the internal and external forces acting on the body and the effects produced by these forces.

Block Periodization: This entails giving one quality in training special emphasis. Using specific exercises that focus on the particular quality you seek, in a conjugate sequence, you maintain your other qualities and then rotate your emphasis and continue maintenance.

Body Composition: percentages of fat, bone, water and muscle in human bodies.

Bones: Bones provide the framework for our bodies. They cocoon organs and serve as the crux of our body's stability.

Branched-chain Amino Acids: An amino acid having aliphatic side-chains with a branch (a central carbon atom bound to three or more carbon atoms).

Burns Training Principle: 2–3-inch quick movements at the end of a set.

C

Calorie Expenditure: number of calories a person burns in a day.

Carbohydrates: body's preferred energy source. A carbohydrate is composed of hydrogen and oxygen. There are two kinds of carbohydrates: the simple ones (sugars) and the complex ones, which include starches and fibers.

Cardiac Muscle: Which includes the heart, as smooth muscle is modulated by the autonomic nervous system.

Cartilage: Cartilage is a firm, elastic, flexible white material. It is found at the ends of ribs, between vertebral discs, at joint surfaces, and in the nose and ears.

Central Nervous System: central nervous system (CNS) consists of your brain and your spinal column. CNS receives messages and, after interpreting them, sends instructions back to the body.

Cheating Exercises: This entails swinging a weight past a sticking point; on a front raise, it might be a slight hip bump out of the bottom; on a bent-over row, it might be a slight vertical pull on the way up; it may be a "kip" to finish off your last rep on pull-up.

Cheating Training Principle: Swing weight past the sticking point at the end of a set to add stress.

Circumduction: sequential combination of movements outlining a geometric cone.

Closed-kinetic-chain Exercises: Exercises performed in which the hand (for arm movement) or foot (for leg movement) is fixed in space and cannot move.

Coenzyme Q10: An antioxidant.

Common Lower Back Injuries: These include spondylosis, spondylolisthesis, spinal stenosis, interarticularis, herniation of discs.

Compensatory Acceleration Training: Moving submaximal weights as fast as possible.

Compound Sets Training Principle: Alternating two exercises for one body part with little rest between sets.

Concentric Strength: amount of weight you can lift one time with an all-out muscle contraction.

Connective Tissue: primary function of connective tissue is to connect muscle to bones and to connect joints together.

Continuous Tension Training Principle: Maintain slow, continuous tension on muscles to maximize red-fiber involvement.

Contract-Relax Method: Method performed with a partner who carefully provides resistance for the muscle being stretched prior to actually stretching it.

Contracted Exercises: Exercises in which constant tension is placed on the muscle throughout the movement.

Contrast Antagonist-Relax Method: Facilitates an increase in muscle length through a maximum isometric contraction of the antagonist immediately prior to a static stretch of the agonist.

Contrast Bath Therapy: A therapeutic modality where a portion of your body, or your entire body, is immersed in cold water followed by warm water; this is done for several alternating cycles.

Creatine Monohydrate: A nitrogenous organic acid that occurs naturally in vertebrates. Its main role is to facilitate recycling of adenosine triphosphate (ATP), the energy currency of the cell, primarily present in muscle and brain tissue.

Cryotherapy: Ice massage.

Cycle Training Principle: Breaking your training year into cycles for strength, mass, or contest preparation.

D

DC (Doggcrap Training): Developed by bodybuilder Dante Trudel, this training method is characterized by lower-rep, higher-intensity workouts.

Deload: A purposeful reduction in training volume & intensity for the purposes of recovery, injury prevention, and improved performance.

Density Progression: A shortening of rest periods between sets.

Descending Sets Training Principle: Using lighter weights from set to set as fatigue sets in.

DEXA Scan: Uses a whole-body scanner along with two different low-dose X-rays that read soft tissue mass and bone mass.

Drop Sets: A technique in which you rep out a weight, quickly reduce the weight, lift again to failure, etc., for the desired number of drop sets.

Dynamic Situations: Forces acting on the body are not in equilibrium, setting the body in motion.

Dynamic Stretching: Active movements of muscle that bring forth a stretch but are not held in the end position.

E

Eccentric Strength: amount of weight you can lower without losing control.

Eclectic Training Principle: Combining mass, strength, or isolation-refinement training techniques into your program as your instincts dictate.

Electromyostimulation: elicitation of muscle contraction using electric impulses.

Electromyostimulation (EMS): EMS incorporates the use of electrical current to activate skeletal muscle and initiate contraction.

EMG: Measures muscle response or electrical activity in response to a nerve's stimulation of the muscle.

Environmental Stressors: These are stressors that put strain on our body (injury, illness, hot/cold temperatures).

Essential Nutrients: Those that the body does not produce at all or it makes in insufficient quantities. Because of this, we must obtain these nutrients through our diet.

EuroBlast Training: This type of training consists of pumping the muscles in different ways and suffusing the body part you are working with massive quantities of blood and nutrients that muscles need.

Eversion: outward lifting of the lateral aspect of the foot.

Exercise Progression: Advancing from one exercise to a different one that's more demanding.

Extension: An increase in the angle between two body segments, or simply the return from flexion.

F

F-Max: Maximum amount of force produced.

F/T: relationship between F-max and T-max, or "power."

Fascial Stretching: Deep tissue manipulation.

Fats: You must have fat in your diet; your body uses fatty acids to do things such as building cell membranes and performing core functions in the brain, eyes, and lungs. Some other functions of fats include functioning as a fuel source during exercise, providing insulation, aiding in absorbing fat-soluble vitamins, supplying essential fatty acids, providing protective padding for body structures, and protecting your nerves.

Fiber: Fiber is not an energy source; in fact, the human gut cannot digest it. However, fiber has protective qualities. It helps promote efficient intestinal function such as regulation and absorption of sugars into the bloodstream. Fiber also helps soften the stool and promotes normal defecation patterns.

First-Class Lever: Has its fulcrum at a point between the resistance and the force (as in a seesaw).

Fitness Fatigue Model: Model looks at the long-term aftereffect from training stimuli.

Flexibility: ability to flex, extend, or circumduct the body's joints through their intended full range of motion without substantial decrement in limit strength.

Flexible Nonlinear Periodization: This is like the undulating training model but allows changes in training based on the readiness of an athlete, which is based on specific tests done pre-workout.

Flexion: A decrease in the angle between two body segments.

Flushing Training Principle: Doing 3–4 exercises for a body part before moving to another body part.

Force: Mass times acceleration (F = ma).

Forced Reps: Lifting a weight to failure and then being assisted by a partner to do more reps, taking the bodybuilder past the normal failure barrier.

Forced Reps Training Principle: Partner-assisted reps at the end of a set.

Foundational Training: main purpose of foundational training is to strengthen your weaknesses, recover from any injuries, and develop a "foundation" of strength in all muscles, tendons, ligaments, and health and fitness.

Frontal Plane: A vertical plane passing through the body from left to right, dividing it into front and back portions.

G

GAS Principle: GAS stands for "general adaptation syndrome." Periods of high intensity must be followed by periods of low intensity.

German Volume Training: This is a training routine originally used by German weightlifters in the off-season to gain lean muscle mass. It consists of 10 sets of 10 reps with the same weight for each exercise. You want to begin with a weight you could lift for 20 reps to failure if you had to.

Giant Set: Combining three (or more) exercises without resting between exercises

Giant Sets Training Principle: Doing 4–6 exercises for one muscle group with little rest between sets.

Glucose Polymers: more densely branched glycogen, sometimes called "animal starch."

Golgi Tendon Organ: Located at the musculotendinous junction, it detects the magnitude of mechanical stress on the muscle. When excessive tension develops, the GTO causes the motor cortex of the brain to terminate muscle contraction and relax.

H

Heavy Duty Training: Developed by Mike Mentzer, this system calls for infrequent, brief, and very intense workouts.

Helping Synergists: Two muscles are helping synergists when they cancel each other's normal movement, allowing the desired movement to occur.

High Intensity Interval Training (HIIT): A cardiovascular exercise strategy alternating short periods of intense anaerobic exercise with less intense recovery periods.

High-Frequency Fatigue: Also known as electromechanical failure, this is characterized by an excessive loss of force at high frequencies of stimulation and rapid recovery when the frequency is reduced.

Holistic Training Principle: Using a variety of rep/set schemes, intensity, and frequency to maximize muscle mass.

Horizontal Plane: Passes through the body in a line parallel to the ground, dividing the body into upper and lower portions.

Human Growth Hormone: Also known as somatotropin, is a peptide hormone that stimulates growth, cell reproduction, and cell regeneration in humans and other animals.

Hydrostatic Weighing: Applies Archimedes' principle that an object immersed in a fluid loses the amount of weight equivalent to the weight of the fluid displaced by the object's volume. Because fat is less dense than muscle is, fatter individuals have a lower total body density than their leaner counterparts do.

Hyperextension: increase in the angle beyond the anatomical point of normal joint movement.

Hyperplasia: enlargement of an organ or tissue caused by an increase in the reproduction rate of its cells.

Hypertrophy: Muscle hypertrophy involves an increase in size of skeletal muscle through a growth in size of its component cells.

I

IGF-1: A primary mediator of the effects of growth hormone (GH). Growth hormone is made in the anterior pituitary gland, is released into the bloodstream, and then stimulates the liver to produce IGF-1.

Insulin: A hormone produced in the pancreas by the islets of Langerhans that regulates the amount of glucose in the blood.

Intra-Workout: During workout.

Inversion: inward lifting of the medial portion of the foot, a common cause of ankle injuries.

Inward Rotation: Occurs when a body segment moves toward the midline.

Iso-Tension Training Principle: Method of practicing posing, tensing each muscle maximally for 6–10 seconds for up to a total of 30–44 flexes in a variety of posing positions.

Isolation Exercises: Exercises that include only one limb and a limited number of muscles.

J

Joints: Joints function as our body's movement centers. They are an intersection where collagen based structures, which include tendons, cartilage, and ligaments, all meet as they collectively stabilize the rounded head of the bone within the capsule of the joint.

K

Kinesiology: study of human movement.

L

L-Glutamine: An alpha-amino acid that is used in the biosynthesis of proteins.

Law of Acceleration: States that the acceleration of an object is proportional to the force causing it and is in the same direction as that force.

Law of Action-Reaction: States that for every action (force) there is an equal and opposite reaction (force).

Law of Individual Differences: This law states that not everyone can train in the same manner.

Law of Inertia: States that a body will remain at rest or in motion until acted on by an outside force.

Laws of Overcompensation and overload: Training must progressively increase in intensity over a period.

Ligaments: Ligaments connect bones to bones at a joint and, along with collagen, contain a somewhat elastic fiber called elastin.

Limit Strength: Limit strength is how much musculoskeletal force you can generate for one all-out effort.

Limit Strength: Limit strength is the ability to produce maximum force voluntarily in a given action.

Linear Periodization: basic premise of this type of periodization is that the training cycle starts with low intensity and high volume; progressively the intensity increases, and subsequently the volume decreases. As reps decrease, the weight used (intensity) increases in each successive mesocycle generally lasting 3–4 weeks.

Load Progression: practice of simply adding weight to the bar.

Low-Frequency Fatigue: In this type of fatigue, low-frequency force output is limited despite adequate electrical stimulation.

M

Macrocycle: A macrocycle can be thought of as an entire training period.

Macronutrients: Those nutrients that the body needs in large amounts.

Mean EMG Activation: average electrical activity of a muscle during the exercise performed.

Mechanical Advantage of a Muscle: amount of resistance overcome in proportion to the amount of effort expended.

Mechanical Tension: Equates to muscular force in a strength-training exercises.

Mesocycle: A mesocycle is a periodic breakdown in a macrocycle.

Metabolic Stress: Acid buildup in the muscle.

Microcycle: A microcycle is described as one cycle in intensity.

Mid-range Movements: These movements target a large number of muscles and force them to work together to lift the weight. Synergists assist in lifting the weight.

Minerals: A chemical substance (such as iron or zinc) that occurs naturally in certain foods and that is important for good health and performance.

Motor Unit: Consists of a single neuron and all the muscle fibers innervated by it.

Muscle: A group of motor units physically separated by a membrane from other groups of motor units.

Muscle Confusion Training Principle: Constantly varying exercises, sets, reps, and weight to avoid accommodation.

Muscle Insertion: insertion (distal attachment) of a muscle is referred to as the moving point and is away from the body.

Muscle Origin: origin (proximal attachment) of a muscle is referred to as the fixed point and is toward the center of the body.

Muscle Priority Training: In this type of training, you simply work your weakness first, before you are too fatigued.

Muscle Priority Training Principle: Working your weaker body parts first in any given workout.

Muscle Spindles: Muscle spindles are sensory receptors within the belly of a muscle that primarily detect changes in the length of this muscle. They convey length information to the central nervous system via sensory neurons.

Myofibrils: Small bundles of myofilaments.

Myofilaments: elements of the muscle that shorten upon contraction.

Myosin: Short, thick filaments that make up part of myofilaments.

N

Negatives (Eccentric Training): Using supramaximal weights and performing only the eccentric portion of the lift.

O

Objectivity: A test that is objective measures without reference to outside influences.

Open-kinetic-chain Exercises: Exercises that are performed in which the hand or foot is free to move.

Outward Rotation: Occurs when a body segment moves away from the midline.

Overloading Parameters: Load, repetition, volume, density, and exercise.

Overreaching: A much shorter and less severe state of overtraining. Many times, you can recover from this in just a few days. Many periodized training programs purposely invoke phases of overreaching to provide variety of the training stimulus and to maximize the supercompensation effect during the periods of less intensity.

Overtraining: A state reached by an athlete training too hard without proper recovery characterized by decreased motivation, sex drive, depression, decreased appetite, and insomnia along with a large decrease in performance.

P

Pacinian Corpuscle: Small, elliptical bodies that lie in close proximity to the GTOs. They are sensitive to quick movement and deep pressure.

Partial Reps: A movement performed in a specific range of motion.

Peak Contraction Training: Isolating a muscle by minimizing the contribution of synergist muscles engaging the overload principle of isolation.

Peak EMG Activation: highest amount of electrical activity during the exercise.

Periodization: Refers to how one's training is broken down into discrete time periods called macrocycles, mesocycles, and microcycles.

Periodization Training: Refers to how one's training is broken down into discrete time periods called macrocycles, mesocycles, and microcycles. Essentially, we look at long-term and short-term planning by systematically cycling methodology, volume, and intensity toward one's goals.

Peripheral Heart Action Training: This training method focuses on keeping blood circulating throughout the body for the entire workout. This is done by attacking the smaller muscles around the heart first and then moving outward.

Peripheral Nervous System: peripheral nervous system (PNS) does two things: (a) It relays messages from the CNS to the body (the efferent system), and (b) it relays messages to the CNS (the afferent system) from the body.

Physiological Advantage of a Muscle: ability of a muscle to shorten.

Plane: A plane is a flat surface. Three imaginary planes pass through the human body. Each plane is perpendicular to each of the other two.

PNF Method: Involves a shortening contraction of the opposing muscle to place the target muscle on stretch. This is followed by an isometric contraction of the target muscle.

Post-exhaustion Training: This is the opposite of pre-exhaustion in which the heavy compound movement is performed first in the workout and the isolation movements are performed later in the workout.

Post-Workout: After your workout is completed.

Powerbuilding: A hybrid of powerlifting and bodybuilding.

Pre-exhaustion Training: Using a single-joint "isolation" movement to failure before performing a heavier multi-joint "compound" movement is performed is called pre-exhaustion training. A practical example would be leg extensions before front squats (for the quadriceps) or cable flyes before the bench press for the chest.

Pre-Exhaustion Training Principle: Supersetting a lighter isolation movement before the heavier compound movement.

Prime Mover: muscle that produces the most force to move a bone.

Progressive Overload Training Principle: Gradually increasing the difficulty of workouts by increasing different variables.

Pronation: rotation of the forearm to the palms-down position (as in a basketball dribble or on the seated chest press machine).

Proprioceptors: Your body's built-in safeguards against severe muscular injury.

Protein: A substance found in foods (such as meat, milk, eggs, and beans) that is an important part of the human diet and muscle building.

Psychological Stressors: Events, situations, individuals, or anything we see as threatening or negative.

Pyramiding Training Principle: Start a body part session with higher rep/low weight and gradually add weight.

Q

Quality Training Principle: Gradually reducing the rest between sets while maintaining or increasing the number of reps performed.

R

Range of Motion: full movement potential of a joint.

Reciprocal Innervation: When a prime mover muscle (or group of muscles) contracts, the opposing muscle (or group) relaxes.

Reliability: degree to which a test is consistent and stable in measuring what it is intended to measure.

REM Sleep: A kind of sleep that occurs at intervals during the night and is characterized by rapid eye movements, more dreaming and bodily movement, and faster pulse and breathing.

Repetition Progression: act of performing more repetitions per set with the same amount of weight previously used.

Rest-Pause Method: Rest-pause training breaks down one set into several mini-sets, with a brief rest between each.

Rest-Pause Training Principle: Using 85%–90% of your max, do 2–3 reps and put the weight down, then do 2–3 more, rest, do 2–3 more, and rest for a total of 3–4 rest-pauses.

Retro-Gravity Training Principle: Using supramaximal loads in an eccentric only style.

Reverse Linear Periodization: Maximum intensity and low volume are at the commencement of the training cycle; then, as the training cycle progresses, volume is increased, and intensity is reduced.

Reverse Pyramiding: opposite of traditional pyramiding; the base is the heavy weight, and you increase reps and decrease weight as you work your way up the pyramid.

Right and Left Rotation: Defines the directional rotation of the head or trunk.

Rotation: circular movement of a body segment about a long axis.

S

Sagittal Plane: A vertical plane passing through the body from front to back, dividing the body into left and right portions.

SAID Principle: SAID stands for "specific adaptation to imposed demand." body will adapt in a highly specific manner to the stress it receives.

Sarcomere: basic unit of muscle contraction.

Satellite Cells: Satellite cells serve to repair damaged muscle tissue, inducing muscle growth after overload from weight training.

Second-Class Lever: Has its resistance at a point between the force and the fulcrum (as in a wheelbarrow).

Selective Androgen Receptor Modulators: They are intended to have the same kind of effects as androgenic drugs like anabolic steroids do but to be much more selective in their action,[1] allowing them to be used for many more clinical indications than the relatively limited legitimate uses that anabolic steroids are currently approved for.

Self-Myofascial Release: A manipulative treatment that attempts to release tension in the fascia due to trauma, posture, or inflammation.

Sequence of Training: order in which you do your lifts in a given workout.

Set System Training Principle: Performing multiple sets for each exercise to apply maximum adaptive stress.

Seven Granddaddy Laws: These include the law of individual differences, the law of overcompensation, the law of overload, the SAID principle, the law of specificity, GAS principle, and the law of use/disuse.

Size Principle of Fiber Recruitment: States that those fibers with a high level of reliability (slow-twitch fibers with the fewest motor units) will be recruited first, and those with lower levels of reliability (fast-twitch fibers with the greatest number of motor units) will be recruited last.

Skeletal Muscle: Blends into tendinous insertions that attach to bones, pulling on them, which generates desired movement.

Skinfold Test: A clinical method used to estimate a person's percentage of body fat, in which a pinch of skin from one of seven particular areas—biceps, triceps, subscapular, suprailiac, abdomen, thigh, and calf—is measured by a caliper.

Sliding Filament Theory: This theory states that a myofibril contracts by the actin and myosin filaments sliding over each other. Chemical bonds and receptor sites on the myofilaments attract each other, allowing the contraction to be held until fatigue interferes.

Smooth Muscle: Governed by the autonomic nervous system and includes the muscles that line the digestive tract and protect the blood vessels.

Split Training System: A type of training that divides training sessions by body regions, pushing and pulling days, antagonist body parts (muscles that oppose each other are trained in the same workout), or movement-based splits (in which one compound movement is performed each day). These are just a few examples of different splits, but the list goes on.

Stabilizer Muscle: When a muscle stabilizes or fixes a bone so that movement can occur at another bone articulating with the stabilized bone.

Staggered Sets: Stagger your smaller and slower developing body parts between sets for larger muscle groups, such as doing a set of wrist curls or concentration curls between sets of leg presses or squats.

Staggered Sets Training Principle: Injecting 10 sets of boring forearm, abdominal or calf work in between sets for, say, chest or legs.

Static Situations: Forces acting on the body are balanced, and there is no movement.

Static Strength: amount of weight you can hold stationary without losing control.

Static Stretching: Means a stretch is held in a challenging but comfortable position for a period, usually between 10 and 30 seconds.

Stressors: This is anything that causes the release of stress hormones.

Stretch Movements: These movements put a muscle at a position of maximal elongation. idea is to activate the stretch reflex so you can recruit muscle fibers that may not have been directly hit with the compound movement.

Stretch Reflex: As a muscle is stretched, muscle spindles become activated, and the brain receives a message that tells the muscle to contract. A rapidly stretched muscle stores elastic-like energy; this stretch reflex sparks a quick contraction.

Subangles of A (Acceleration): Acceleration is best achieved by improving explosive strength (your ability to turn on as many muscle fibers as possible and leave them on). In the strength curve, the angles of A should become greater and greater (positive acceleration).

Superset: When two exercises are performed consecutively without a break

Superset Training Principle: Alternating opposing muscle group exercises with little rest between sets.

Superspeed Training Principle: Compensatory acceleration of movements to stimulate hard-to-reach fast-twitch fibers.

Supination: rotation of the forearm segment to the palms-up position (as in doing a standard curl on the arm curl machine).

Synthetic Thyroid Hormones: t4 and t3.

T

T-Max: time it takes to reach F-max.

Tabata Training: A popular form of interval training that includes performing an activity all out for 20 seconds, followed by a 10-second rest interval.

Tempo Training: Involves performing reps at a prescribed cadence.

Tendons: Tendons are extensions of the muscle fibers that connect muscle to bone.

Third-Class Lever: Has its force at a point between the resistance and the fulcrum (as in a shovel). This is the most common lever in the body.

Time Under Tension (TUT) Training: Focusing on how long a set or rep takes rather than just reps.

Traditional Pyramiding: Involves performing sets consisting of high reps at the beginning of the workout (base of pyramid), working toward the top of the pyramid by decreasing reps and increasing weight.

Tri-Sets Training Principle: Doing three exercises for one muscle group with little rest between sets.

True Synergists: role of a true synergist is to cancel the undesired movement of a prime mover while not participating in the desired movement.

Type I Muscle Fibers: (Slow-twitch or red fiber) are highly resistant to fatigue and injury, but their force output is very low. Activities performed in the aerobic pathway call upon these muscle fibers.

Type IIa Muscle Fibers: (Fast-twitch or intermediate fibers) are larger in size and much stronger than Type I fibers are. They have a high capacity for glycolytic activity—they can produce high-force output for long periods.

Type IIx Muscle Fibers: (Fast-twitch muscle fibers) are often referred to as “couch potato fibers” because of their prevalence in sedentary individuals. Research has shown that 16% of a sedentary person’s total muscle mass is of this fiber type.

U

Undulating Periodization: Training volume and overall intensity are increased or decreased constantly.

Unilateral Exercises: Training one limb at a time.

V

Validity: extent to which a test accurately measures what it is supposed to measure.

Variable Manipulation: Different elements you can vary to increase (or decrease) intensity. Rest periods, weight on the bar, and number of sets are all examples of variables you can change.

Vitamins: Any of various relatively complex organic substances found in plant and animal tissue and required in small quantities for controlling metabolic processes

Volume Progression: Adding another set of the same weight and repetitions performed previously.

W

Weider System/Principles: A collection of training philosophies and programs gathered by Joe Weider from the top athletes and coaches of the time.

Wilks Formula: An equation to compare athletes of different weight divisions with each other.

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